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ACTIVITIES OF
THE MARKETING AND FACILITIES RESEARCH BRANCH
DURING THE FISCAL YEAR ENDED JUNE 30, 1953



UNITED STATES DEPARTMENT OF AGRICULTURE
PRODUCTION AND MARKETING ADMINISTRATION
WASHINGTON, D. C.

AGRICULTURE—WASHINGTON

**ORGANIZATION OF THE
MARKETING AND FACILITIES RESEARCH BRANCH**

William C. Crow, Director
Budd A. Holt, Deputy Director

**MARKETING FACILITY
PLANNING IN SPECIFIC
LOCALITIES**

Develops plans and promotes the construction of the proper kinds of marketing facilities for all kinds of farm and food products at various stages in the marketing channel in specific localities; determines the type, size, location, design, cost, and method of financing and operation best suited for the specific locality; determines the financial soundness of the proposed facility; advises architects and builders before and during construction; and assists in getting the new facility properly operated.

**MARKETING FACILITY AND
MATERIALS-HANDLING
PRINCIPLES**

W. H. Elliott, In Charge

Conducts studies to determine the principles that should be followed in ascertaining the proper size, layout, location, and method of financing and operating marketing facilities, and to determine the best kind or kinds of equipment for use in handling products at various stages in the marketing channel. The principles developed are followed in planning marketing facilities and equipment to fit specific localities and areas.

**TRANSPORTATION FACILITIES,
EQUIPMENT AND LOADING
METHODS**

J. C. Winter, In Charge

Conducts research in transportation for all types of agricultural commodities, including but not restricted to studies and investigations of transportation facilities, methods, equipment, practices and operations, and studies of transportation legislation, policies, and regulations in order to increase transportation efficiency, reduce costs, improve quality, and generally to expand the distribution of farm and food products.

**WHOLESALE, RETAILING,
AND PACKAGING**

R. W. Hoecker, In Charge

Conducts research on merchandising, packaging, wholesaling, and retailing, in order to increase efficiency, reduce costs, improve quality and consumer acceptability, and generally to expand the distribution of farm and food products.

**MARKET NEWS AND
GRADING**

K. J. McCallister, In Charge

Conducts studies and investigations to develop technical improvements which will increase the effectiveness of market news, inspection, and grading programs.

**MARKETING SERVICE
PROGRAMS**

L. G. Foster, In Charge

Work with State departments of agriculture in developing and conducting marketing service programs, on matched-funds basis, to improve the efficiency and reduce the costs of the distribution of farm and food products.

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ACTIVITIES OF THE MARKETING AND FACILITIES RESEARCH
BRANCH DURING THE FISCAL YEAR ENDED
JUNE 30, 1953

SUMMARY

The primary objective of the activities conducted by the Marketing and Facilities Research Branch is to find ways to improve the efficiency and hold down the cost of marketing farm and food products. These activities are confined to problems that cut across commodity lines. In carrying out these activities the Branch works in close cooperation with other agencies and groups concerned with marketing, including other branches and bureaus of the U. S. Department of Agriculture, State departments of agriculture and bureaus of markets, State agricultural colleges, municipalities, trade and farm organizations, transportation agencies, equipment manufacturers, engineering firms, and other groups concerned with improving the efficiency of marketing.

Most of the work of the Branch is carried out under the authority of the Agricultural Marketing Act of 1946 and in accordance with recommendations of industry advisory committees established pursuant to that Act. Individual programs are conducted in close cooperation with marketing firms and transportation agencies. The laboratory for conducting much of the research work of the Branch has been warehouses, stores, transportation equipment, and other facilities of individuals and firms engaged in the marketing or transportation of farm and food products.

The programs of the Branch consists primarily of: (1) Developing plans for and promoting the construction of the proper kind, of marketing facilities for handling farm and food products in producing areas, concentration points, and terminal and secondary markets; (2) determining the best methods, kinds of equipment, and uses of equipment for handling products at the various stages in the marketing channel and for package-line operations so as to reduce labor and other operating costs and minimize losses and damage to the product; (3) improving transportation facilities, methods, equipment, practices, and operations in order to increase transportation efficiency, reduce costs, maintain quality, and expand the distribution of farm and food products; (4) finding improved methods of wholesaling, packaging, and retailing; (5) developing improvements in the market news and grading services so that better information will be available to guide the marketing processes; and (6) working with State departments of agriculture in developing and conducting marketing service programs on a matched-funds basis to improve the efficiency of the distribution of farm and food products.

The main activities conducted by the Branch during the year are summarized under the eight headings immediately following. More complete statements are given in the body of the report, and at the end is a list of recent publications of the Branch.

PLANNING MARKET FACILITIES IN SPECIFIC LOCALITIES

The objective of the work of the Branch in planning marketing facilities in specific localities, as stated in the Agricultural Marketing Act of 1946 in directing that such work be undertaken, is to *determine the needs and develop or assist in the*

development of plans for efficient facilities and methods of operating such facilities for the proper assembly, processing, transportation, storage, distribution, and handling of agricultural products. This work involves a wide variety of activities in planning and promoting the construction of improved facilities for all kinds of farm and food products throughout the country. The work is undertaken on request of local authorities and is conducted in cooperation with marketing agencies and State and municipal institutions. Its purpose is to reduce the cost of marketing and expand the outlets for farm and food products.

During the year market facilities, previously planned by the Branch, were in varying stages of construction in eleven cities. In the Atlanta, Ga. produce market a new store building with eight store units was constructed and placed in operation. In June 1953, a market site was acquired for the farmers' market at Jacksonville, Tex. and the facilities should be completed and in operation for handling the 1953 fall vegetable crops. Plans were announced in April 1953 for the construction of a new \$1,750,000 wholesale produce marketing facility in Louisville, Ky. In Nashville, Tenn. a site for improved facilities has been acquired and in May 1953 a contract was let to put the site in condition for building. Construction work on a new market facility in Savannah, Ga. was near completion at the end of the year and should be in operation in about 30 days. In line with the plans developed by the Branch the new facilities include an administration building, six dealers' store buildings, and sales sheds for farmers and truckers. In Hartford, Conn. a new wholesale produce market was formally opened on November 16, 1952. Representatives of the Branch and State and City officials participated in the formal opening. Since operations began in this market Branch representatives have assisted the management in various phases of operation. The Market Authority in Rochester, N. Y. is negotiating for the purchase of a 68-acre site and plans to start construction in the near future. Construction of a new wholesale produce market in St. Louis, Mo. was completed during the year and occupied by dealers in February 1953. In April 1953 ground-breaking ceremonies were held on the site of the new produce terminal in Houston, Tex. The new market is to be built on one of the sites favorably considered in the report of the Branch. A new produce market is under construction in Indianapolis, Ind. with the layout of facilities closely following those proposed by the Branch. The Market Authority, created by the State of Massachusetts to construct facilities recommended by the Branch for a new wholesale food district in Boston, has been unsuccessful in developing the project but meat wholesalers have proceeded with the construction of their part of the proposal in the area recommended. At the end of the year some of these wholesale meat plants had been completed and were in operation and the remaining meat stores were under construction.

Studies were made during the year to develop plans for improved market facilities in 13 other localities in 10 States. These include three studies begun in the previous fiscal year and ten started in the current year. Plans for a new wholesale market site and facilities for Bridgeport, Conn. were presented to local groups in January 1953 and a report was published in April. This new market would cost about \$1,500,000. Estimated savings to dealers, for whom store space is planned, and to farmers, truckers, and buyers would amount to at least \$60,000 annually. In June 1953 a preliminary report was presented to the Twin City group recommending one consolidated wholesale produce market for the metropolitan area of Minneapolis and St. Paul, Minn. Alternate plans were given for separate facilities for each city in the event they could not get together on a single market. Three other cities for which the

Branch conducted studies of the needs and plans for improved wholesale produce markets are San Diego, Calif., Milwaukee, Wis., and Birmingham, Ala.

A report on the study conducted in cooperation with the Department of Agriculture and the Agricultural Extension Service of North Carolina, published in June 1953, sets forth findings and recommendations for improved grain marketing facilities and practices in western North Carolina. It is estimated that good storage and handling facilities and practices would save between \$5,000,000 and \$6,000,000 annually in the cost of bags and bag handling and in reducing the damage to grain caused by high moisture and insects. A report on a second grain study is being prepared on the facility needs in the Coastal Plains area of North Carolina. A third study of grain marketing facilities and handling practices in South Carolina was started in the spring of 1953 in cooperation with State and local agencies.

Four studies conducted during the year were concerned with the facilities for the handling of eggs. A report entitled *Egg Marketing Facilities in the Winston-Salem, N. C. Trade Area*, published in March 1953, recommended against facility expansion in this area at the present time. The other three egg studies covered the assembly plants in Pennsylvania, Texas, and Virginia. In South Carolina a study was made to determine the needs for new turkey and broiler processing facilities. The largest broiler processing plant in the State was remodeled and equipment added, as recommended by the Branch.

In addition to the detailed studies to develop plans for improved market facilities in specific localities, the Branch was called upon frequently throughout the year by individuals for advice and suggestions on building single warehouses, stores, and other types of marketing facilities.

MARKETING AND STORAGE FACILITY RESEARCH

The objective of research in this field is to determine principles and develop standards or criteria which can be used either by the Branch in planning market facilities in specific localities or by individual firms in planning their own facilities. These standards or criteria cover such principles as: (1) Improved layouts and designs for facilities of various types and sizes, (2) the amount of space needed in facilities in relation to volumes handled, (3) location in relation to supply and demand factors and selection of sites, (4) methods of financing construction and site acquisition, (5) methods of operating facilities, and (6) external factors that may affect the success of facility operations.

A study of the principles for planning egg assembly facilities was begun in April 1951 and a first report entitled *Candling, Sizing, Packing, and Materials-Handling Equipment and Methods Used in Egg Assembly Plants*, was published in June 1953. The study covered 25 plants in 6 States. It provides plant operators with basic tools for analyzing their operations. The report considers such materials-handling principles as balanced handling, unit load, mechanized equipment, materials flow, review of operations, and preventive maintenance. Plans for plant layouts were also studied and a second report presenting principles of layout and design has been prepared and will be published during the next fiscal year.

The second group of studies is concerned with principles applicable to livestock auction markets. A study conducted in cooperation with the Texas Agricultural Experiment Station covers improved layouts, designs, and methods of operating auction markets in that State. A report on part of this work to be published soon by the Texas Station, makes detailed recommendations for these improvements. The numerous facilities and kinds of equipment required by the improved methods are illustrated by charts and pictures. In applying the principles involved in these improvements in an auction market handling about 700 cattle and 200 hogs per sale, it is estimated that the number of workers required on sales days would be reduced, from the present average of 27, to 23. Work on other phases of the Texas study was initiated in February 1953. Work on a similar study of livestock auction markets in the southeastern States, in cooperation with experiment stations, was started by the Branch in May 1953. Observations have been made of the operations and methods used in 15 markets in Georgia, Florida, and Mississippi. Work is planned in Virginia and Louisiana for the fall of 1953.

A study to improve order assembly room layouts for frozen food distribution plants has continued during the year. Case studies conducted in 12 plants show many inefficiencies in order assembly operations. These include time spent in pushing cartons on dead conveyors, waiting time resulting from unbalanced workloads, excessive handling of invoices, inadequate supervision of night work, and loss of time in receiving and transcribing orders in the office and transmitting them to the workrooms. Analysis also indicates great need for methods of reducing errors in filling orders. The need for improved equipment in the assembly operations has received special attention. By June 1953 new and improved equipment and revised methods had been installed in four pilot distribution plants. In one plant mechanical operations reduced the total warehousing crew from 11 to 8 men and the use of pallet racks in improving stacking methods increased the storage capacity by one-fifth. In another order assembly system labor requirements have been materially reduced by the use of special push carts. Results of some of these tests will be published during the next fiscal year.

Field work was completed during the year on a study of principles applicable to the designing of efficient store buildings for produce dealers and sales sheds for farmers and truckers in wholesale produce markets. Also a study has been under way since November 1952 on the organization, management, and finance of wholesale markets. Data from 40 markets will be analyzed in this study which should be completed early in 1954.

The objectives of a final study in this general field are to develop principles and data which cotton warehousemen may use in selecting the location, equipment, methods, arrangement of facilities, storage patterns, size and type of structures, and fire preventive system that will result in the lowest over-all cost per bale for handling any particular volume of business. Much of the field work on this study has been completed.

MATERIALS-HANDLING RESEARCH

At each stage in the marketing channel for farm and food products, beginning at assembly and shipping points and ending with retail stores, products are unloaded from and loaded on the carriers, stacked and broken out of stacks, in moving them into, within, and out of the various marketing and storage facilities through which they move. This handling requires thousands of workers and millions of man-hours of labor. To handle the increased volume of products needed to supply an expanding population, which demands both additional goods and services, unnecessary handling operations must be eliminated and labor must be provided improved methods and equipment for doing its work, if marketing costs are to be maintained at present levels or reduced. That is, the productivity of labor employed in marketing must be increased just as the productivity of labor on farms has been increased. Meeting this general objective means that plant operators must be provided improved methods for using their present equipment and criteria which can be used as a guide for selecting the proper kinds and amounts of equipment if a change is to be made. This also means that new equipment must be developed for special handling operations where existing types are not satisfactory.

During the year studies of handling methods and equipment by the Branch have been conducted for apple packing and storage houses, public refrigerated warehouses, cotton warehouses, and stores and warehouses of fruit and vegetable distributors. The Washington State Apple Commission has completed the contract study, mentioned in our 1952 report, on handling methods and equipment in Pacific Northwest apple plants. Eighty Washington State apple houses have purchased and used one or more of the portable mechanical lifts developed in this study for high-piling boxed apples with resulting annual savings around \$1,500 per machine. The contractor gave technical assistance on materials-handling problems to 24 plants. It is estimated that this assistance will save about \$120,000 annually in handling costs. Material from the contractor's 950-page report will be published by the Branch in a series of five reports. The first, *Apple Handling Methods and Equipment in Pacific Northwest Packing and Storage Houses*, published in June 1953, covers an appraisal of methods and equipment for handling both loose and packed boxes of apples into, within, and out of apple packing and storage houses.

Some of the results of a study of materials-handling in public refrigerated warehouses were given in our 1952 report. This contract study has been completed and a report for publication should be ready by January 1954. The study shows that, in single-story warehouses, handling by use of industrial fork-lift truck and pallet methods is more efficient than by using other types of equipment. In multistory warehouses, handling pallet loads on 4- and 6-wheel hand platform trucks from carriers to stacking points (or the reverse in loading out) and stacking pallet loads by industrial lift trucks proved superior to other methods.

The objectives of the work in stores and warehouses of fruit and vegetable distributors are to develop data and to determine for all kinds of packages of fruits and vegetables the most efficient types of equipment for performing the materials-handling operations. Emphasis during the year was on completing work pertaining to the receiving, ripening, and cutting of bananas. A report on this work should be in

final form in October 1953. It will appraise seven different types of equipment used in these operations. In conducting this work assistance has been given to dealers in improving their materials-handling operations, including assistance on the design and layout of new facilities which should improve the efficiency of their fruit and vegetable operations.

A report entitled *Cotton Handling Guide for Warehouse Managers and Foremen*, published in June 1953, suggests techniques by which cotton warehousemen can analyze their handling operations to detect waste and inefficiency and for planning and instituting more efficient methods. The report shows the chief causes of inefficiency to be failure to make effective use of labor, to substitute power equipment for manual labor, and to make effective use of the equipment used. During the year promising results have been obtained on the use of specially designed breaking-out equipment. A report on three methods of breaking-out flat bales of cotton stored on head will be released during the ensuing fiscal year. The objectives of these and other studies being conducted are to find more efficient ways of handling cotton in warehouse operations where much manual labor has been used in the past.

METHODS STUDIES OF PACKING-LINE OPERATIONS

Operations involved in preparing products for market also require large amounts of labor. These operations, sometimes referred to as *packing line* operations, are usually performed at a fixed work station. They may include dumping, cleaning, sorting, sizing, packing, lidding, labeling, and stamping. In these operations the product itself is handled. This means a greater chance for damage than when the produce is handled in containers. The general objective of research in this field is to develop improved methods and equipment for performing packing operations so as to reduce labor requirements, losses from spoilage and deterioration, and investment in facilities. Results of initial laboratory research in this field, concerning visual inspection problems in grading, were given in our 1952 report. Those results, while significant and basic, were obtained by the use of wooden objects simulating fruit and vegetable products. The validity and applicability of those laboratory results have since been tested by research in commercial plants on grading lemons, oranges, and white potatoes. In the case of lemons and oranges it was found that proper speeds of translation and rotation and the proper number of rows of fruit moving past the inspector reduced labor requirements 75 and 67 percent, respectively, from that required by using the regular grading belts in the test plants. For potatoes the saving was 10 percent. A report on this work entitled *Visual Inspection of Products for Surface Characteristics in Grading Operations*, was published in June 1953. A second study on packing-line operations, conducted under contract with the Washington State Apple Commission, is concerned with improving methods and equipment for sorting, sizing, and packing apples. In checking the performance of three types of apple sorting tables in this study it was found that the reverse roll table which rotates the fruit as it passes the inspector has the greatest possibilities for saving labor. Work to improve this table has been undertaken.

TRANSPORTATION FACILITIES, EQUIPMENT AND LOADING METHODS

Transportation research programs of the Branch during the year included: (1) Work to improve the services and obtain better utilization of carrier equipment; (2) the study of equipment to provide better protection for products at lower costs; and (3) research on methods of stowing, bracing, and shipping, to reduce loss and damage in transit and lower costs.

During the year the Branch has worked on many problems involved in the development of more effective and efficient refrigeration equipment and methods for the transportation of perishable foods, especially frozen foods transported by motor-truck. In cooperation with equipment manufacturers, truckers, and shippers, numerous shipping tests of perishable foods have been made to determine the effectiveness of different equipment and methods. New methods, suggested by the Branch of using dry ice in motortruck shipments of perishables gave improved results when tested in three cross-country shipments of frozen citrus concentrates, hard-frozen pork bellies, and chilled beef quarters. Results of these tests were reported in two Branch publications issued in April and June 1953. Another new refrigerating system for motortrucks, using dry ice as a basic refrigerant but employing a secondary refrigerant in cooling coils, was tested in a shipment of frozen citrus concentrate from Florida to Philadelphia, Pa. A report of this test was published in April 1953. Another report entitled *A Test Concerning Dry Ice and Mechanical Refrigeration in the Transportation of Frozen Citrus Concentrate by Motortruck*, published in February 1953, shows more effective temperature control from mechanical refrigeration, especially when used with a return air duct and ample clearance space for air circulation, than obtained from placing blocks of dry ice on top of the load and on the floor at the rear of the truck. In another test of a relatively new type of mechanical refrigeration, reported in March 1953, frozen turkeys were shipped by motortruck from Modesta, Calif. to Medford, Mass. in November 1952 and arrived, after 10 days en route, with a temperature of -13.4° , a rise of only 2.6° after loading.

In response to a recommendation at the March 1953 meeting of the Transportation Advisory Committee, the Branch in cooperation with other governmental agencies is developing plans to find ways of minimizing the buildup of moisture condensation in the insulating material of refrigerated motortrucks.

A handbook for truckers designed to supply information on the protection of perishable commodities while in transit, proper equipment to use, loading methods, and other related matters, has been completed and will soon be published.

Initial work has been done to find means of improving railroad and motortruck equipment to minimize injury to livestock in transit. Tests are being made of a non-skid floor covering supplied by the Asphalt Institute. The Branch has continued to work with a committee of the American Railway Engineering Association on the problem of developing methods to improve transit time. Assistance was given in the preparation of a report made at the Association's annual convention in March 1953, where it was decided to conduct more intensive surveys similar to the *movement ratio* originally suggested by the Branch.

In another area of transportation activities research results have demonstrated that much of the transit loss and damage to perishables can be eliminated by improved shipping containers and improved methods of loading, bracing, and stripping of shipments. The *WGA crate* developed under a research contract with the Western Growers Association of Los Angeles, Calif., for use in the shipment of ice-packed lettuce and carrots, was reviewed in our 1952 report. A final report on the development of this crate and related work was published in May 1953. The *WGA crate* nearly replaced other wooden shipping containers for lettuce and carrots but the subsequent development of the vacuum cooling process, permitting lettuce to be shipped without crate or body ice, has opened opportunities for the use of cheaper fiberboard cartons. Due to the numerous questions raised as a result of this development a substantial part of this year's work under the Association's contract is concerned with appraising the relative effectiveness and cost of the two general types of containers.

A summary report published in May 1953 on *Loss and Damage in the Transportation of Cantaloups, 1950-52*, recommends the on-end loading method for cantaloups and estimates that its use would save at least \$2,000,000 annually.

In a contract study entitled *Container Breakage in Top-Iced Shipments of Vegetables*, published in May 1953, it was found that, contrary to popular belief, melting of ice was substantially greater at the end of the cars nearest to the bunker bulkhead and that more effective refrigeration and less breakage of containers would result if the top icing were banked to a depth of about 24 inches at the ends and not more than 12 inches in the middle of the car. Other phases of work conducted under contract with the Association during the year included: (1) test shipments to determine whether cauliflower could be effectively and more efficiently transported with a greater trimming of the wrapping leaves, and (2) test shipments of an all-purpose container for shipping tomatoes from California to eastern destinations.

In initial shipping tests for watermelons it was found that less damage resulted from loading Congo melons crosswise instead of lengthwise in the car. Further tests will be made in fiscal year 1954. Other transportation problems receiving attention from the Branch during the year include new shipping containers for plums, palletizing and unitizing shipping containers, and the effects of heavier loading of railroad cars in the shipment of perishables.

WORK ON WHOLESALING, RETAILING, AND PACKAGING

Approximately one-half of the total costs of marketing farm products is required for performing the functions of wholesale and retail distribution. Notwithstanding the many improvements which have been made in retailing during recent years the performance of this function alone continues to require the largest gross margin of any of the steps in the food marketing channel. Retailing is important from another viewpoint, since it is in the retail store that the consumer decides whether to take a product or to leave it. Improvements in retailing are important not only to retailers but also to consumers and farmers.

In conducting research in this general area the Branch works in close cooperation with many retail and wholesale firms and with trade associations in this field. Wholesale warehouses and retail food stores have been the laboratories for much of this work.

During the year the grocery trade has shown an increasing interest in the work and publications of the Branch. For instance, summaries or excerpts from a Branch publication entitled *Some Improved Methods of Handling Groceries in Self-Service Retail Food Stores*, issued in 1952, have been printed in most retail trade periodicals. It also provided source material for the first three *Store Managers' Helper* circulars, issued by the Super Market Institute.

A publication entitled *Receiving, Blocking, and Cutting Meats in Retail Food Stores*, was issued in June 1953. It reports the results of research conducted by the Branch in cooperation with two large supermarket organizations to find ways of reducing the cost of performing these operations. In four stores in which selected improvements in methods, materials and equipment were made, labor productivity for the combined receiving, blocking, and cutting operations was increased by 26.6 to 38.9 percent. Labor requirements for these operations were reduced by 8.5 to 28.4 man-hours per week. It was found, for instance, that the number of sides of beef received per man-hour could be increased by 82.1 percent through the use of an overhead meat rail and a meat hook stabilizer. The time required to block a side of beef was reduced about 15 percent by improved methods and equipment. In the cutting operation, labor productivity was substantially increased by many improvements including an improved workplace arrangement, a new type cutting table, a special smear remover used with the power saw, and a special combination hand saw and knife.

Substantial progress has been made in a study designed to develop improved methods of handling produce and frozen food in service and self-service retail food stores. Basic data have been collected to determine the present allocation of man-hours of types of produce for each major handling operation. A comparative analysis of present handling methods and equipment is largely completed. During the following year improved work methods, equipment and layout will be developed and tested and their use encouraged in additional markets.

In 1951 the Branch issued a report on a check-out counter which was 38 percent more productive than conventional equipment. Since then some improvements on this equipment have been made by industry. These improvements have been incorporated into new counters which are being tested in several stores.

A report entitled *Packaging and Displaying Meat in Self-Service Meat Markets*, issued in June 1953, completes one phase of the work on prepackaging of meat, poultry, and animal products. The objective of this work is to improve the efficiency of these operations through the development of improved handling methods, equipment and layout. Packaging and displaying of self-service meats in two typical food stores required over half the total meat market man-hours. In two stores in which selected improvements were made in these operations, labor productivity was increased 10 and 23 percent, saving 10.6 and 31.2 man-hours per week, respectively. In addition material

costs were reduced by more than \$19 and \$10 per week in the two stores. Many detailed improvements developed in the meat wrapping operations resulted in substantial savings in both labor and material costs. For instance, in two markets the use of proper sizes of boards, trays and cellophane saved 8 percent of the board and tray costs and 19.4 percent of the cost of the film. Improved methods were also developed in the pricing, weighing, and displaying operations.

The study, mentioned in last year's report, on finding ways in which wholesalers and retailers can cooperate to increase their combined efficiency and lower food distribution costs has been carried a step further this year. The report, *Views of Independent Grocers on Wholesaler-Retailer Relations*, published in June 1953, summarizes the views of about 1,700 retail customers of eight wholesalers. A basic finding of this survey is the need for wholesalers to tailor their retailer assistance programs so as to meet the requirements of the different kinds of retail operations. Most retailers are interested in some of the several special services offered by wholesalers. These interests, however, vary greatly among the types of grocers. Among other findings, the survey discloses that many retailers are willing to accept various proposals from wholesalers designed to reduce the costs of delivery.

Further work has been done during the year to improve the efficiency of departmental display space in retail food stores. Food retailers have shown unusually favorable interest in the report, *Better Utilization of Selling Space in Food Stores-Part 1*, issued in June 1952 and reviewed in the 1952 annual report.

An initial study in a new line of research begun in 1952, has been completed. The general objective of this work is to help obtain the full potential value of sound operating procedures and improved equipment by better personnel management practices, thus holding down the cost of retailing food. A first report entitled *Improving the Performance of Retail Food Store Cashiers Through Better Training Methods*, was issued in June 1953. It summarizes the results of a study conducted in cooperation with two supermarket organizations to determine the relative effectiveness of two methods of training cashiers. The training method which gave the cashiers an opportunity to discuss their work and to participate in training conferences proved much more effective in improving employee performance than the conventional method of instruction by written memorandum. This was the case in obtaining acceptance of new procedures, in obtaining adherence to established procedures, in extending courtesies to customers, in obtaining utilization of time when not serving customers, and in giving employee satisfaction.

STUDIES TO IMPROVE MARKET NEWS

Effective operation of the marketing system for agricultural commodities requires timely and accurate market information. A major part of this information is gathered and reported by the market news services of the Department. For these services to do a good job many different phases of the program must be periodically studied, the accuracy of releases checked, any shortcomings discovered, and improvements made. Studies undertaken by this Branch to improve market news are recommended by the Office of the Assistant Administrator for Marketing or heads of the various market news services.

During the year three studies were completed by the Branch and recommendations made for improving the market news service in the commercially important broiler producing sections of the Shenandoah Valley of Virginia, West Virginia, and North Carolina. For the Shenandoah Valley section the reporting of prices paid producers for birds was made more current by reporting as of the day sales were negotiated rather than the established practice of reporting as of the day the birds were picked up and payment made, usually one to four days later. At the same time the reported prices were made more useful since they reported only one day's transactions rather than sales negotiations over several days. By using an earlier cutoff time in gathering data it was possible for the noon broadcast of the local radio station to report the market one day earlier. These and other market news service improvements have been made in this section as a result of the study.

The nearest market news information available to the broiler producing sections of West Virginia when this area was studied came by leased wire from the Shenandoah Valley of Virginia and was distributed by the West Virginia Department of Agriculture. The study revealed that broiler prices in the Wardensville section of West Virginia were comparable to those in the Shenandoah Valley and, as recommended by the study, the Virginia Market News reports have been improved by including information from the Wardensville section. Other improvements, applicable to the South Branch section of West Virginia, have been made. Also, in the broiler producing sections of North Carolina where market information needs are quite different, the service has been improved as a result of the study.

Changes in methods of marketing poultry and eggs during recent years have necessitated that a complete appraisal be made as to the adequacy of other market news reports for these products. The Branch has undertaken a study, in cooperation with the Poultry Branch, to improve market news reporting of the volume of poultry and eggs moving through assembling and processing plants. Since July 1952, receipts of eggs, hens, cocks, broilers, and turkeys from 200 plants in 17 Midwestern States have been gathered and reported on a research basis. Some of the problems receiving attention in this study are methods of gathering data, size of sample, and accuracy of the reports.

Work to develop test methods of reporting feed market news was continued during the year. The trial reporting conducted under contract with the University of Arkansas was discontinued in June 1953. These reports proved practical and useful. The methods developed in this study are now being used on a regular service basis by the States of Arkansas and Alabama.

An analysis was completed and a publication issued on methods of reporting volume of retail sales of individual food commodities. This was part of an over-all study to determine the practicability of market news reporting at the retail level.

DEVELOPING NEW SERVICE WORK IN MARKETING

The Agricultural Marketing Act of 1946 authorizes cooperative projects between the U. S. Department of Agriculture and the State departments of agriculture under which the latter conduct marketing service activities on a matched-fund basis. A program for developing new marketing service activities under this authority has been in operation since 1948. In February 1953 direct supervision over this program was transferred to the Branch from the Office of the Assistant Administrator for Marketing.

Effective governmental aid in improving the marketing of agricultural commodities requires much more than the conducting of marketing research and the dissemination to the public of the knowledge gained from such research. It also requires marketing service work in diagnosing marketing ills, prescribing proper remedies, and rendering on-the-spot assistance in the application of the remedies. The State departments of agriculture through their regular activities such as market news, grading and inspection, and regulatory work are brought in close contact with the marketing operations and marketing agencies in their States, and are, therefore, in a favorable position to conduct marketing service work.

Under the above legislative authority, three broad areas of marketing service work have been developed, with each participating State conducting one or more lines of work within one or more of these areas. Briefly, the broad areas of work include: (1) Demonstrations and other activities at the various steps in the marketing channel designed to improve and maintain the quality of agricultural products and to expand sales volume; (2) technical assistance to marketing agencies designed to help them in making improvements in marketing methods, facilities, and plant layouts and thereby reduce operating costs; and (3) collecting and disseminating needed market information which is not otherwise available and conducting experimental market news services.

During the year 32 States and 3 Territories participated in this program. They conducted 89 separate lines of work in the above three areas. These new lines of marketing service work have added to and supplemented the regular programs of the State departments of agriculture. Annual reports from the States covering their activities during the year under each line of work are now being received. These will be analyzed and summarized. A summarization of these activities should be ready for publication in December 1953.

PLANNING MARKETING FACILITIES IN SPECIFIC LOCALITIES

The greater part of the cost of marketing is the expense of the physical handling of products into, out of, and between a succession of marketing facilities in the distribution channel between the farmer and the consumer. The inefficiency of marketing facilities for farm and food products, with the high cost of distribution resulting, has been the subject of five Federal investigations during the past 35 years. Most of these investigations resulted in the issuance of reports describing the conditions found and pointing out the seriousness of the problem. But one of these investigations by the Committee on Agriculture of the House of Representatives resulted in the enactment of the Agricultural Marketing Act of 1946 which, among other things, directed the Department of Agriculture *to determine the needs and develop or assist in the development of plans for efficient facilities and methods of operating such facilities for the proper assembly, processing, transportation, storage, distribution, and handling of agricultural products.* In compliance with this directive the Branch has been engaged in a wide variety of activities in planning and promoting the construction of improved marketing facilities for all kinds of farm and food products throughout the country.

The work of the Branch is limited to complying with requests for assistance in planning efficient marketing facilities when the request indicates a seriousness of purpose and a real need. The work is done in cooperation with marketing agencies and State or municipal institutions. There is no Federal assistance in financing the construction of the facilities planned. When work is undertaken in any locality a complete study of existing facilities and methods of handling is made; the volume of products being handled, or likely to be handled, is ascertained; handling costs are determined; and, on the basis of this analysis of the current situation, a determination is made of the kind, amount, and design of facilities that would meet the needs. If satisfactory facilities can be provided at reasonable cost by improving the facilities currently in use, such action is recommended. If not, a complete new layout for new facilities in another location is drawn up. The approximate cost of providing the facilities and the savings that would result from operating in them are calculated. The complete plan is then presented by use of scale models in meetings of interested groups. After full discussion and taking into consideration the comments made, a report is published setting forth the findings of the study and the recommended course of action.

Of course the local groups must take the initiative in bringing about the construction of the facilities, but after the organization has been formed to build them, the site purchased, and architects employed, such additional assistance as is needed is provided during the course of construction to make certain that the facility is properly built and placed into successful operation.

The kind of facilities planned include facilities at all stages of the marketing channel for all types of farm and food products including large city wholesale markets for fruits, vegetables, poultry, eggs, meat, frozen food, butter, cheese, and other perishables; warehouses; livestock auctions; elevators; packing and shipping sheds; farmers' markets; egg assembly plants; etc. A single facility may contain wholesale store buildings, warehouses, farmers and truckers' sheds, railroad tracks, and

other facilities for bringing together, displaying, storing, handling, and selling a wide variety of products coming from all parts of the country, or it may be a relatively simple assembly market in a producing area at which products are brought in by farmers for grading, packing, sale and shipment to some distant city. The whole purpose of the work is to reduce the cost of marketing and expand the outlets for farm and food products.

During the year this type of work was done in 24 localities scattered over 17 States, in addition to the furnishing of a great deal of miscellaneous assistance to persons and groups in other places. In 11 of these 24 places new facilities were in some stage of construction following the issuance of recommendations by the Branch. In the other 13, formal studies were completed or in process. The status of the work in each of these places and some illustrations of the miscellaneous type of assistance given in other places are briefly set forth in the following paragraphs.

MARKET FACILITIES UNDER CONSTRUCTION

During the year market facilities planned by the Branch were in varying stages of construction in 11 cities. In these places assistance was given in revising plans to fit the sites purchased, advising the architects and engineers on design and layout, suggesting ways of dealing with problems arising during construction, and aiding in decisions on methods of operation. Each year the amount of time required for followup work on markets constructed, being constructed, or proposed following recommendations of the Branch increases. It is important after a study has been completed that everything reasonably possible be done to get the necessary facilities built into satisfactory operation. The status of the construction in each of these 11 localities is discussed below.

1. Atlanta, Ga.: In its report on Atlanta, Ga., produce markets, published in August 1947, the Branch developed plans for improving and expanding the facilities on the Atlanta State Farmers' Market which would facilitate its growth as the central wholesale market in that area. In line with these plans, a new store building, containing a total of 43,200 square feet of enclosed floor space, was constructed and placed in operation during the past year. This building, which contains two stories plus basement, is 400 feet wide and 36 feet deep. An 8-foot covered platform is provided along the front of the structure at the first- or main-floor level. At the rear, a platform of the same depth is provided at the basement floor level. Direct rail connections also are provided at this level and conveyors are installed in each unit to move receipts arriving by rail to the first and second floors. The building is divided into 8 units or stores each of which is 50 feet wide and 36 feet deep. The new facility increases the total floor space in store buildings on the market roughly 35 percent and should permit the more efficient handling of a larger volume of produce.

2. Jacksonville, Tex.: In June 1953 the Jacksonville Farmers' Market, Inc., which was organized for the purpose of constructing and operating a market facility in that city, acquired a 12-acre site at the south city limits as the first step in carrying out its program. Initially the new facility will serve as a shipping point fruit and vegetable market and the buildings to be constructed at this time are in line with the plans developed by the Branch and published in its report of June 1950. It is expected that the new facilities will be completed in the fall of 1953 and the market placed in operation for handling the fall vegetable crops.

3. Louisville, Ky.: In April 1953 officials of the Louisville Produce Association announced plans for the construction of a new \$1,750,000 wholesale produce market facility in that city. Financial arrangements have been completed and a contract covering the construction of facilities has been let. Following closely the plans developed and published by the Marketing and Facilities Research Branch and the University of Kentucky in October 1950, the new facility will consist of two dealer store buildings each containing 30 units and two farmer and trucker sales sheds each containing 50 stalls. All stores will have direct rail connections. The new market will be located on a 50-acre site in the southwest section of the Louisville metropolitan district just off the new inner belt highway. Construction of the new facility is expected to take about eight months.

4. Nashville, Tenn.: In its report on the Nashville, Tenn., wholesale produce market, published in June 1951, the Branch recommended the reorganization and improvement of the present market, rather than the construction of a new facility at a new location, and suggested a site that might be acquired to carry out such a program. The Davidson County Farmers Market Commission now has acquired title to the roughly 56 tracts comprising the 16-acre site suggested. On May 19, 1953, the Commission let a contract covering the work required to put the site in condition to build. This includes grade, fill, storm and sanitary sewers, and retaining walls. This work is scheduled to be completed in six months and will be followed closely by the construction of facilities.

5. Savannah, Ga.: At the end of the year construction work on the new Savannah State Farmers' Market was nearing completion and it was expected that the facility would be placed in operation in about 30 days. The new facility is located on a 20-acre tract at the traffic circle on U. S. Highway 80. In line with the market plans developed by the Branch and published in its report of February 1950, the new facility consists of: (1) An administration building having space for the manager's office, three brokers' offices, barbershop, cafe, and long-distance telephones; (2) six dealers' store buildings all of which are connected by a continuous front platform; and (3) a sales shed for farmers and truckers. Each of the six store buildings contain four units, each of which is 20 feet wide and 40 feet deep. In addition to the 20-foot platform in front, a 10-foot platform is provided at the rear. All units have rail sidings alongside the rear platforms. The sales shed for farmers and truckers is 302 by 80 feet. Eight-foot display platforms, which run the full length of the shed, are provided on each side. Allowing 10 feet of platform space per vehicle, a total of 60 sellers can be accommodated simultaneously.

6. Hartford, Conn.: The new wholesale produce market at Hartford, Conn., was formally opened on November 16, 1952. (See fig. 1.) Representatives of the Marketing and Facilities Research Branch, the Connecticut Department of Farms and Markets, and officials of the city of Hartford were participants in the formal program which was attended by many trade representatives from nearby markets.

The wholesale produce dealers began operations in the market a few weeks prior to the formal opening date. All wholesalers of fresh fruits and vegetables, with the exception of one firm which deals in prepackaged commodities, are now operating on the new market. One store unit in the market is occupied by a wholesale dealer in meats, another by a wholesaler dealer in frozen foods.

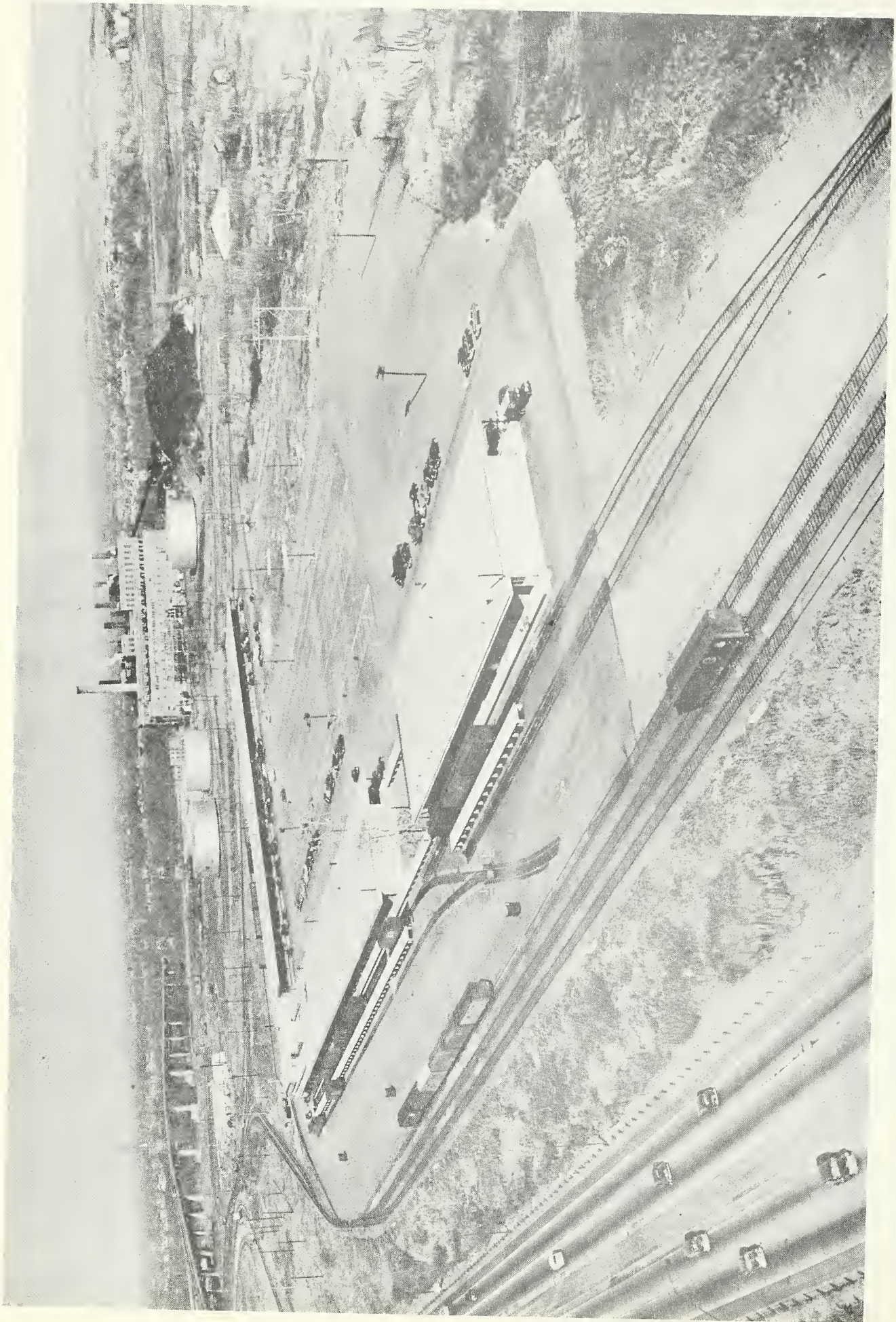


Figure 1.--The Hartford, Conn., wholesale produce market.

From time to time during the year, representatives of the Branch have assisted the management of the new Hartford market in planning various phases of market operation and in January 1953, the Branch prepared a publication entitled *A Plan for Further Development of the Connecticut Regional Market at Hartford*. This master plan for future expansion was prepared at the request of the Connecticut Regional Marketing Authority.

7. Rochester, N. Y.: In January 1953, a report, *The Wholesale Produce Market at Rochester, N. Y.*, prepared jointly by the Branch and the Department of Agriculture and Markets, New York, was published. On several occasions during the year, representatives of this Branch met with engineers employed by the Genesee Valley Regional Market Authority to discuss layout and design of facilities in the proposed market. The Authority is at present negotiating for purchase of a property containing 80 acres situated in the town of Henrietta, which adjoins Rochester immediately to the south, and plans to start construction of the market in the near future.

8. St. Louis, Mo.: Construction of the new wholesale produce market at St. Louis, Mo., was completed during the year, and was occupied by wholesale dealers in the month of February 1953. (See fig. 2.)

9. Houston, Tex.: In April 1953, ground breaking ceremonies were held on the site of the new Houston produce terminal. The new market is to be built on one of the sites favorably considered in the report, *The Wholesale Market for Fruits, Vegetables, Meat and Meat Products, Poultry, Eggs, and Other Produce at Houston, Tex.*, prepared by this Branch and published in 1948. The property adjoins the Houston Belt and Terminal Railroad. Two other nearby rail lines make this a favorable location for handling produce received by rail. Recent improvements have been made in highways serving the property.

The Houston Produce Terminal Association, owners of the new market, plan initial construction of stores to accommodate dealers in fruits and vegetables. Sufficient area is available for the expansion of these facilities and for the inclusion at a later date of stores for wholesale dealers in meat and meat products, poultry, and eggs.

10. Indianapolis, Ind.: A new wholesale produce market is under construction in Indianapolis. This facility, when completed, will handle fruits, vegetables, poultry, and eggs, and arrangements are being made by some dry grocery wholesalers and chain store warehouses to locate in the area. The layout of this facility follows closely that proposed by the Branch in a report published in June 1950.

11. Boston, Mass.: In 1950 the Branch issued a report proposing the construction of a new wholesale food district in Boston to handle fruits, vegetables, meats, poultry, eggs, and related products. The State of Massachusetts then created a Marketing Authority to construct the recommended facilities. After this Authority was unsuccessful in its effort to develop the project, the meat wholesalers decided to proceed with the construction of their part of the proposal in the area recommended. As the year ended some of these wholesale meat plants had been completed and were in operation and the remaining meat stores were under construction. By the end of the calendar year the entire meat section of the market, costing several million

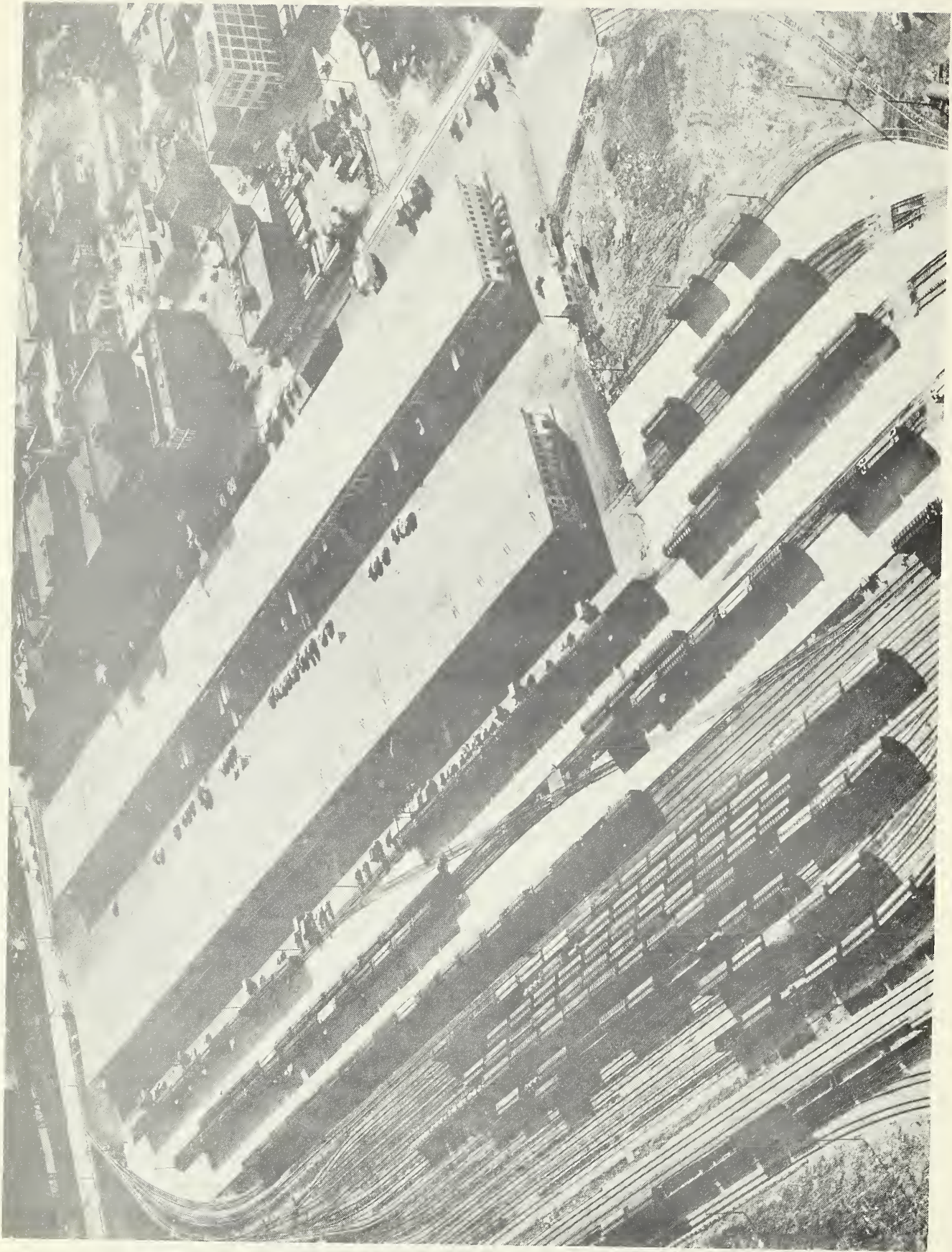


Figure 2.--The St. Louis, Mo., wholesale produce market.

dollars, should be completed. Efforts are now being made to bring about the construction of the two other sections of the market district to handle fruits, vegetables, poultry, and eggs.

MARKETING FACILITY STUDIES MADE

During the year studies were made to develop plans for improved marketing facilities in 13 localities in 10 States. Three of these studies were begun toward the end of the previous fiscal year, but 10 of them were started during the current year. They included facilities handling nearly all types of farm and food products. The nature of the work done on each is briefly described below.

1. Bridgeport, Conn.: Field work on a study of wholesale market facilities in Bridgeport was finished in July of 1952 in cooperation with the Connecticut Department of Farms and Markets. The plan developed provides stores for 13 fruit and vegetable dealers; 4 dealers in meat and meat products, eggs, and dairy products; and 5 wholesale grocers. It also includes a section for farmers and truckers with platform space for 25 of these operators under an open shed. Seventeen acres would be required for the stores and sheds, together with adequate rail trackage, parking areas, streets, market manager's office, and a restaurant. It was recommended that an expansion area of at least 8 acres be included in the site.

Since there is no suitable site within the city, several sites in the adjoining town of Stratford were considered most desirable for the location of this market.

It was estimated that on the basis of 1952 building costs and including cost of land, a market could be built on any of the proposed sites at a cost of about \$1,500,000. In order to pay for these facilities, pay taxes, and the cost of management, and provide a reserve for contingencies of approximately 15 percent, it would be necessary to obtain an income from rents of about \$190,000 each year. These rents would be more than double the amounts now paid. However, this added expense would be more than offset by savings on cartage, deterioration, spoilage, and the advantage of doing business on a single floor, compared with a multistory operation. Net savings to dealers for whom store space is planned are estimated at about \$45,000 a year. Other estimated annual savings include \$4,200 to farmers and truckers, and \$11,250 to buyers. With the objective of reducing costs of operation in a wholesale market and at the same time preserving the benefits of consolidating wholesale business in one area, the report suggests an alternative plan. Under this plan a corporation developing the new market would function only as a landowner. This market corporation would acquire a site and develop a master plan for the inclusion of streets, sewers, and utility services. Buildings which would be restricted in height, observe reasonable property lines, and otherwise conform with the master plan could be built by dealers on land acquired from the corporation on long-term leases.

In January of 1953, a preliminary report of this study was given in Bridgeport to a group of wholesale dealers in all commodities, to farmers, city officials, and representatives of the Connecticut Regional Market Authority. Scale models were used to illustrate the proposed layout and facilities. Several suggestions made at this meeting were incorporated in a report which was published in April 1953.

2. St. Paul - Minneapolis, Minn.: Upon the request of the cities of St. Paul and Minneapolis and the wholesale dealers, brokers, and market gardeners in the Twin Cities, a study of the marketing facility needs was made in cooperation with the Minnesota Department of Agriculture, Dairy and Food and the University of Minnesota. The study was begun in November 1952 and completed in March 1953. A preliminary report was presented to the Twin City groups on June 29, 1953, outlining the findings, conclusions, and recommendations. One combined, consolidated wholesale produce market to serve the two cities and the metropolitan area was recommended. Such a development as the one recommended would require the construction of 61 wholesale store units, 40 brokers' offices, 475 covered stalls for farmers and truckers, restaurant, market office, railroad tracks, streets, and parking areas, at an estimated cost (including land) of about \$1,573,000. Net savings in a new market amounting to more than \$220,000 annually, in spite of higher rents, would come about through reduced cartage costs and a reduction in some losses from theft, spoilage, and breakage. Savings in handling produce into and out of facilities would be substantial, but no estimate of these savings was made.

Much doubt was expressed by the various groups as to whether the two cities could get together on a single market to serve the two cities and their metropolitan area. Therefore, alternative plans for the improvement of market facilities in each city were given.

A preliminary report outlining a market improvement program for St. Paul only was presented on June 30, 1953. The study revealed that the wholesale dealers and farmers in St. Paul had a greater need for facility improvements than those in Minneapolis. The study also showed that the St. Paul group could reduce their marketing costs substantially by building 22 wholesale store units, 275 covered stalls for farmers and truckers, office space for brokers, and parking areas, at an estimated cost of \$590,000.

To offset higher rentals in a new market St. Paul dealers would save by reducing the present costs of cartage and by eliminating much of the loss now suffered from theft, spoilage, and breakage. Net savings from these items were estimated at \$160,000 annually which amounts to a saving of about \$30 per carlot equivalent on the 5,325 cars handled in 1952.

A third preliminary report on these studies was presented to the Minneapolis groups on July 1, 1953, indicating possible improvements that might be made in market facilities in that city in the event they could not get together on a single market to serve the Twin Cities. The study revealed that smaller savings could be effected by a market improvement program for the dealers in Minneapolis than in St. Paul. Annual net savings as applied to rent, cartage, spoilage, theft, and breakage were estimated at \$30,000. Likewise, less interest was shown by the Minneapolis wholesalers in market facility improvements than by those in St. Paul. Facilities needed to consolidate the Minneapolis dealers, farmers, brokers, and independent service wholesalers and other types of wholesale distributors in one area would include 38 wholesale store units, 22 brokers' offices, 275 covered stalls for farmers and truckers, market office, restaurant, railroad tracks, streets, and parking areas, at an estimated cost of \$1,067,000. It was not deemed economical to develop the market around the present municipal farmers' market because of the high land cost.

3. Grain Marketing Facilities in the Piedmont Area of North Carolina: The report setting forth the findings and recommendations of a study of grain marketing facilities and practices in western North Carolina was published in June 1953. This study was made in cooperation with the Department of Agriculture and the Agricultural Extension Service of North Carolina. In the report it is shown that the amount of storage space and handling equipment available off farms and on farms is only a very small percentage of the total needed to do an efficient job in grain marketing and prevent excessive damage to grains by high moisture and insects. It was recommended that the most advantageous point where about 4,000,000 bushels of additional storage space should be built is at the mills in the area. Such mills are about the only buyers of grain in the area, are the principal users, and many of them have substantial amounts of good storage space to which additions can be made economically. The building of storage space for rent to farmers, mills, or other users of grain, to be operated as a separate storage enterprise only, was not recommended. It was suggested that all mills install equipment and handling facilities necessary to do an efficient job in receiving and handling grain in bulk. The lack of good grain bins for the prevention of high moisture and insect damage to grains stored on farms led to the conclusion that about 20,000,000 bushels of additional good storage space was needed on farms in the area. Farmers needed to change over to bulk handling of grains to avoid the high costs of bags and bag handling. With the use of good storage and handling facilities and practices on and off farms it is estimated that a total of more than \$875,000 would be saved annually in the cost of bags and bag handling and a loss of about \$4,868,000 annually in grain damage caused by high moisture and insects could be prevented.

4. Grain Marketing Facilities in Eastern North Carolina: At the request of the North Carolina Department of Agriculture a study is being made of grain marketing facilities in the Coastal Plains area of North Carolina, in order to determine if additional facilities are needed, and, if so, the types, kinds, and places where they are needed in order to help bring about an efficient grain marketing system in the area. In the Coastal Plains area tremendous increases in yields per acre of corn in recent years have led to heavy surpluses above area livestock and milling needs. This surplus corn moves to outside areas, mainly to the Piedmont milling area of North Carolina and to mills in other southern States, as well as northeast by water to export terminals and feed processing plants. Large amounts of soybeans also move from this area to processing plants along the east coast as well as to plants at interior points in other areas. In 1952 about one-half of the corn produced in the area was utilized on farms as livestock feed, but about 90 percent of the soybeans produced moved from farms.

Preliminary analysis of the situation in this area indicates that the major need for off-farm facilities in this area is for those types necessary to facilitate the movement of grains in an economical manner. Additional operative storage is needed, especially in those areas where corn and soybeans are grown as minor sources of income. At country receiving points efficient handling, corn shelling, and loading-out facilities are needed, as well as storage space for assembling grades for shipment and turning and treating grains to prevent high moisture and insect damage. Good storage bins for efficient care of grains remaining on farms are scarce. Farmers can feed high nutrient corn and sell higher grade corn by providing bins which will allow

fumigation of shelled corn and other grains to prevent the high insect damage prevalent in the area. A complete report on this study is in the process of preparation.

5. Grain Marketing Facilities in South Carolina: At the request of the South Carolina State Marketing Commission and the Agricultural Extension Service a study of grain marketing facilities in that State was started in the spring of 1953. The objective of this study is to determine the types and kinds of grain marketing facilities needed and where such facilities should be located in order to bring about a more efficient grain marketing system. The rather large increases in production of corn, oats, and wheat in this State in recent years have given rise to a substantial movement of these grains from farms in one part of the State to another, as well as a movement into other States. The facilities and handling practices in use both on and off farms produce high costs of marketing as well as excessive damage by insects and excessive moisture. As the year ended, the existing facilities, production and movement, and grain handling practices were being studied in cooperation with State and local agencies, business firms, and individuals.

6. San Diego, Calif.: At the request of the Chamber of Commerce of San Diego and the California Department of Agriculture, a study was made early in 1953 of the wholesale produce market situation in San Diego. The rapid expansion in population in the city, as well as its nearness to the Imperial Valley and other concentrated producing areas in southern California gave rise to the question as to the feasibility of the development in San Diego of more efficient market facilities for receiving, handling, and distributing produce. Analysis of the data and information secured in the survey leads to the conclusion that the improvements needed in produce marketing facilities are being brought about by firms doing service wholesaling business. With dairy and poultry products, as well as with meats, all of which are dominated by service wholesaling operations, reasonably good and in some instances excellent facilities were being used. No significant economies could be effected by changing either their locations or facilities. Certain service wholesalers of fruits and vegetables doing a substantial percentage of the total volume of business had plans in the process of being worked out for new and much more complete facilities in more desirable locations. The amount of wholesale business and the types of operators remaining in the old wholesale market area within a year or two stands a good chance of being a relatively small factor in the total wholesale supply situation in San Diego. Therefore, the development of any new facilities in addition to those currently being developed by progressive wholesale dealers was not recommended. A report of this study is in the process of preparation.

7. Milwaukee, Wis.: In cooperation with the University of Wisconsin, the Branch made a supplementary study of the Milwaukee wholesale produce market. A report of the findings and recommendations was presented in Milwaukee on May 4, 1953. The cooperating agency published a final report of the findings and recommendations suggesting that a new wholesale produce market be built on the 35th and Lincoln site, presently owned by the city of Milwaukee. A new market containing 45 wholesale store units, 22½ by 60 feet, 120 covered stalls for farmers and truckers, restaurant, market office, railroad tracks, streets, and parking areas, estimated to cost \$1,083,000 was recommended. Much interest was indicated by the various trade groups for the improvement of their present market facilities.

8. Birmingham, Ala.: In April and May of 1953, a representative of this Branch collaborated with representatives of the Extension Service and Experiment Stations of the Alabama Polytechnic Institute, in making a study of the present facilities used in wholesaling fruits and vegetables, poultry, eggs, and meats in the city of Birmingham. This study was requested by the Jefferson County Truck Growers' Association and certain members of the trade group that handle fresh fruits and vegetables at wholesale. At the end of this year, data were being analyzed preparatory to the drafting of a report which will contain suggestions for improvement of facilities in the wholesale markets at Birmingham.

9. Egg Marketing Facilities in Western North Carolina: At the request of the Agricultural Committee of the Winston-Salem Chamber of Commerce a survey of egg marketing facilities in 18 counties in the Winston-Salem trade area was conducted in cooperation with the North Carolina State Department of Agriculture and North Carolina State College to determine their adequacy and the total volume that could be handled if market egg production was expanded. The findings and recommendations were published in March 1953 in a report entitled *Egg Marketing Facilities in the Winston-Salem, N. C., Trade Area*. It was not recommended that these facilities be expanded at this time.

10. Pennsylvania Egg Assembly Plants: During recent years the production of market eggs has increased rapidly in Pennsylvania and at present it ranks as the largest egg producing State in the country. This heavy production which is in close proximity to terminal market outlets has resulted in a strong trend toward the cartoning of eggs at the point of production. At the request of the Pennsylvania State Department of Agriculture, and in cooperation with Pennsylvania State College, studies of current operations in five egg assembly plants were conducted during the past year and plans were developed for improved methods and facilities. Special emphasis was placed on the reorganization and remodeling of existing facilities to permit the efficient handling and cartoning of shell eggs. Specific recommendations were made for the improvement of facilities to permit the incorporation of the latest improved types of egg candling and cartoning equipment and with a view toward possible future expansion of the volumes handled.

11. Texas Egg Assembly Plants: The development of a program in Texas for buying eggs on a graded basis has resulted in a demand by plant operators for improved layouts for egg assembly facilities which will permit the installation and efficient operation of the necessary candling, cartoning, handling, and refrigeration equipment. At the request of the Extension Service of the Texas Agricultural and Mechanical College, studies were made of six egg assembly plants of varying sizes to determine the facility requirement best suited to local production and marketing conditions. Specific layouts were developed for each of the plants and recommendations were made on the methods and types of equipment that would permit greatest efficiency. Special consideration was given to the incorporation of egg candling and cartoning equipment designed to meet grading requirements and also permit the candling of individual producer lots so as to permit settlement on a quality graded basis.

12. South Carolina Poultry Plants: The rapid development of broiler and turkey production in South Carolina has taxed the capacity of existing poultry processing facilities in that State. At the request of Clemson Agricultural College a survey of

turkey and broiler processing facilities was made to determine the need for new facilities. Plans and recommendations for a turkey dressing plant were developed and submitted to a group of turkey producers. Because of delays on the part of producers in organizing, construction was delayed. Meanwhile additional processing facilities were developed in neighboring areas which are capable of handling the increases in volume. The largest broiler processing plant in the State was remodeled and additional equipment provided in accordance with the recommendations submitted to the plant operator. This plant has been in operation approximately eight months.

13. Virginia Egg Assembly Plants: At the request of the Virginia Department of Agriculture and Immigration and the Poultry Branch, PMA, a study was made of egg marketing facilities for a group of Virginia producers. Although a possible reorganization of existing facilities was suggested, in view of the rapid growth of this organization, it was considered more feasible to construct new facilities than to reorganize existing facilities. The problem was discussed with management and it was felt that new construction would be undertaken within a year and that proposed changes could be incorporated at that time.

MISCELLANEOUS ACTIVITIES ON FACILITY IMPROVEMENT

In addition to the work on marketing facilities described above the Branch was called on frequently throughout the year for advice from individuals desiring to build single warehouses, stores, and other types of marketing facilities. While detailed studies could not be made for such individuals, they were assisted by: (1) Sending them published material applicable to their situation, (2) answering specific questions, (3) reviewing their plans and suggesting revisions, and (4) discussing their problems with them when they could come to Washington. The following illustrations will serve to point out the nature of this work.

In the fall of 1952 the Branch was requested by the Department of Agriculture and the Port Authority of North Carolina to make a study of the feasibility of the construction of port grain terminal facilities, either at Wilmington or Morehead City, C. Analyses were made of the volumes of surplus grains which might utilize such facilities and of water, rail, and truck transportation differentials affecting the movement of grains in North Carolina and to Wilmington in particular. From these analyses it was concluded that the construction of grain terminal facilities at Wilmington would be attended with high financial risk. The probable volume of grain that would be handled and the location of Wilmington with respect to probable grain movement was such that the amount of business that could be expected to be done by the elevator would be too small to pay for its construction and operation.

As a demonstration of the types of grain handling and storage facilities needed in the surplus corn and soybean area in eastern North Carolina, Branch personnel participated in the planning and layout of an elevator near Goldsboro, N. C. The data secured in another study of the entire area were used to establish, to a reasonable extent, the economic feasibility of the proposed facility at this location. The elevator is under construction and is expected to be in operation in September 1953. This modern facility will be used by State and local agencies in their educational work as an example of desirable facilities designed and constructed to do an efficient job in grain marketing.

Personnel of the Branch were called upon by the Market Authority and the Virginia Division of Markets to assist in various aspects of the development of plans for the building and financing of a wholesale produce market for Richmond, Va. Information and visual aids were developed and supplied the Virginia Division of Markets and the Authority to be used in an educational program with the various groups affected by a new wholesale produce market in Richmond.

In June 1951 the Branch issued a report recommending the construction of a central wholesale market in San Juan consisting of docks, warehouses, wholesale stores, stockyard, meat packing plant, grain elevator, feed-mixing mill, sheds for farmers and truckers, and a retail market. In the fall of 1952 the Washington Chapter of the American Marketing Association gave the authors of this report an award for an outstanding contribution of a Government agency to the field of marketing. During this year the report has been published in Spanish by the Puerto Rican Government. The proposal has been approved by the Government of Puerto Rico, and more than \$4,000,000 was made available to start construction. In the meantime the interest in developing the port at the site proposed has broadened to include facilities for handling products other than farm and food products. Engineers have been employed and plans are being completed for the development of an extensive port area including the market. From time to time throughout the year assistance has been given on this project.

Suggested layouts for new and improved egg marketing facilities were developed and forwarded by mail to a total of eight plant operators in Wisconsin, Minnesota, Missouri, Louisiana, and Iowa. Suggestions also were made to these plant operators for revising these plans to meet specific marketing conditions.

Assistance was also given to several individuals interested in building new or remodeling old frozen food distribution facilities and cold storage warehouses. Numerous people from foreign countries have come to personnel in the Branch for assistance and advice on marketing facility improvement, and information requested by other countries has been sent by mail.

MARKETING AND STORAGE FACILITY RESEARCH

The purpose of research in this field is to determine principles and develop standards or criteria which can be used either by the Branch in planning market facilities in specific localities or by individual firms in planning their own facilities. These standards or criteria cover such principles as: (1) Improved layouts and designs for facilities of various types and sizes, (2) the amount of space needed in facilities in relation to volumes handled, (3) location in relation to supply and demand factors and selection of sites, (4) methods of financing construction and site acquisition, (5) methods of operating facilities, and (6) external factors that may affect the success of facility operations.

Principles for Planning Egg Assembly Facilities

In April 1951 a study of egg assembly plants was initiated to assemble data and information on handling methods and plant operations needed to determine the principles of improved layouts for egg assembly facilities. Studies have been made in a total of 25 plants in New Jersey, Minnesota, Wisconsin, Iowa, Texas, and Pennsylvania. In all instances the State Extension Service poultry and egg marketing specialists and/or representatives of the State Departments of Agriculture assisted in the selection of and made preliminary visits with Branch personnel to the plants selected to arrange for cooperation. Their assistance was particularly valuable in selecting plants of varying sizes which were representative of the plants in the area where studies were made.

In each of the plants selected, information was obtained on plant layout, flow diagrams, equipment inventory and arrangement, sequence of operations, and plant productivity. Particular attention was given to the space requirements and layouts of various types of candling and cartoning systems. Photographs of innovations, specialized equipment, improved handling methods, and plant designs were obtained to provide a visual means of illustrating and recommending improved handling methods. The first report entitled *Candling, Sizing, Packing, and Materials-Handling Equipment and Methods Used in Egg Assembly Plants* was published in June 1953. Seven different types of candling, cartoning, and packing production line systems are described and illustrated. Layouts of each of the seven candling production lines under plant operating conditions also are presented. The suggested layout for one of the belt conveyor candling and cartoning systems is shown in figure 3. Space requirements for the various systems, together with illustrations of the different types of equipment, are shown to serve as a guide to plant operators in connection with the remodeling of plants and the installation of equipment. The report develops principles of materials handling for egg assembly plants, in order to provide plant operators with the basic tools required for analyzing their own operations. These principles consist of: Balanced handling, unit load, mechanical equipment, materials flow, review of operations, and preventive maintenance. Some of the improved methods of handling eggs and related supplies presented in the report cover the use of two-wheel hand truck, four-wheel hand truck, dollies, chutes, gravity conveyors, belt conveyors, dead and semilive skids, and combinations of several types of equipment. Several handling methods utilizing different combinations of equipment are illustrated and described for both single- and multi-story egg assembly facilities. Among the handling aids and innovations discussed are auxiliary candling benches, plant

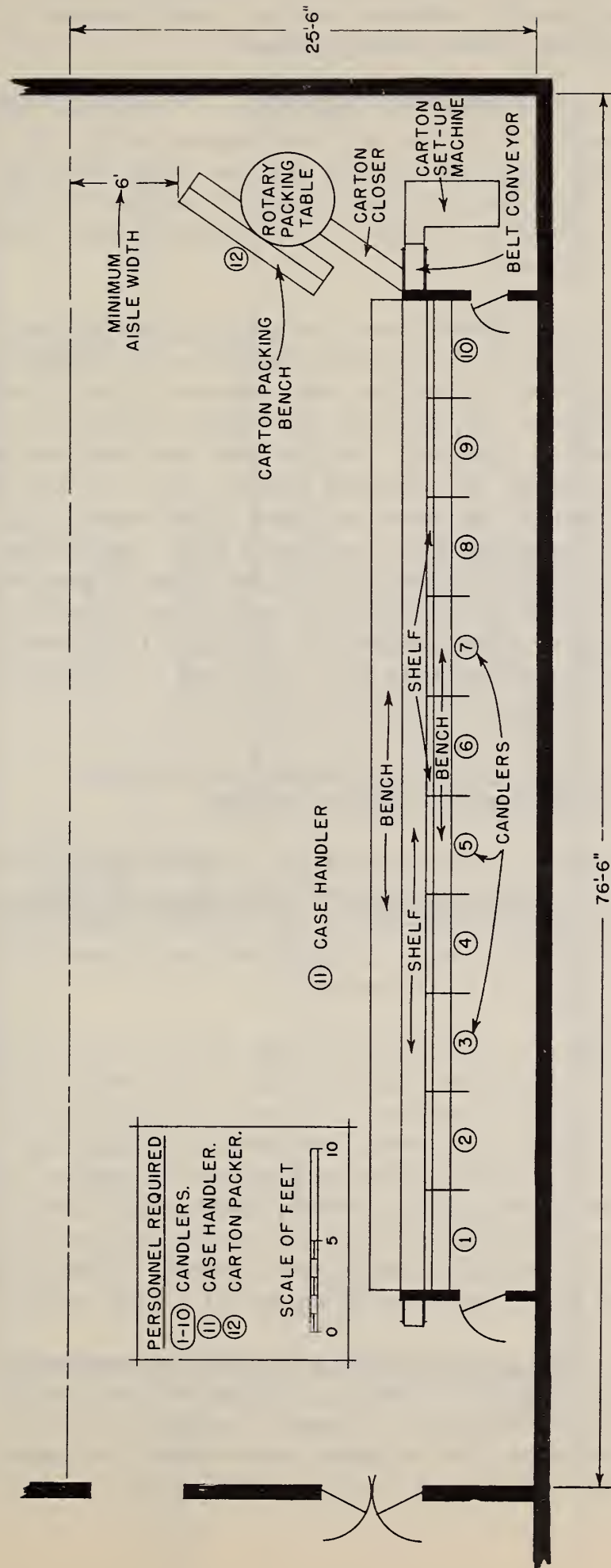


Figure 3.--Layout of belt conveyor system A.

communication systems, driveway signals, mechanical egg cleaners, gummed tape dispensers, wooden and fiberboard case staplers, loading ports for producer egg deliveries and loading out trucks, storage rack for empty producer cases, and a measuring stick for determining a truck loading pattern.

A second report which will present the principles of layout and design for the entire plant has been prepared and will be published during the next fiscal year. To illustrate these principles suggested layouts will be shown for plants handling different volumes of eggs and using different types of equipment. Layouts for the entire plant will be built around the layouts for the candling and cartoning departments presented in the first report.

In connection with the plant layout work, suggested plans and recommendations were developed, in cooperation with the Extension Service at Iowa State College, for the expansion of a plant in Iowa. These plans were adopted by the plant management and the addition was completed in July 1952. An outstanding feature of this plant is complete temperature control of eggs from the time they are received until loaded out which is accomplished through two separate systems, one for refrigeration and one for complete air-conditioning. As shown in figure 4 the layout is 36 by 80 feet and incorporates a cooler, candling room, receiving room, and storage room. The candling room is designed to handle approximately 1,000 cases of eggs per week under local production conditions. Cartoning and packing operations can be incorporated at a later date with a minimum of plant alteration. Because of interest in this new plant, an illustrated article presenting the layout and its basic features was published in the February 1953 issue of *Marketing Activities*.

Improved Layouts, Designs, and Methods of Operating Texas Livestock Auction Markets

In 1951 a study of livestock auction markets in Texas was undertaken by the Branch in cooperation with the Texas Agricultural Experiment Station, to determine the practices, methods of operation, and design of facilities which would increase the efficiency of auction markets, and to establish the economic factors that determine the success or failure of auction markets.

Work on the first subproject has been completed and the report entitled *Texas Livestock Auction Markets--Methods and Facilities* is in the process of publication by the Texas Agricultural Experiment Station. The report provides detailed recommendations for efficient facilities, equipment, and methods of handling livestock at auction markets. Charts and pictures illustrate suggested designs for and the arrangement of unloading and loading docks, chutes, chute pens, catch pens, holding pens, tagging chutes, gates, alleys, feeder chutes, scale rack, sales ring, sales barn, and other equipment, and describes the improved methods of handling livestock. The design of the suggested sales barn is shown by use of a scale model in figure 5.

A market handling about 700 cattle and 200 hogs per sale was used to illustrate the principles that should be used in planning a livestock auction facility in a specific locality. On a market designed, arranged, and operated in line with the suggested layout, it was estimated that managers could reduce the number of workers required on sales days from the present average of 27 to 23, or a reduction of

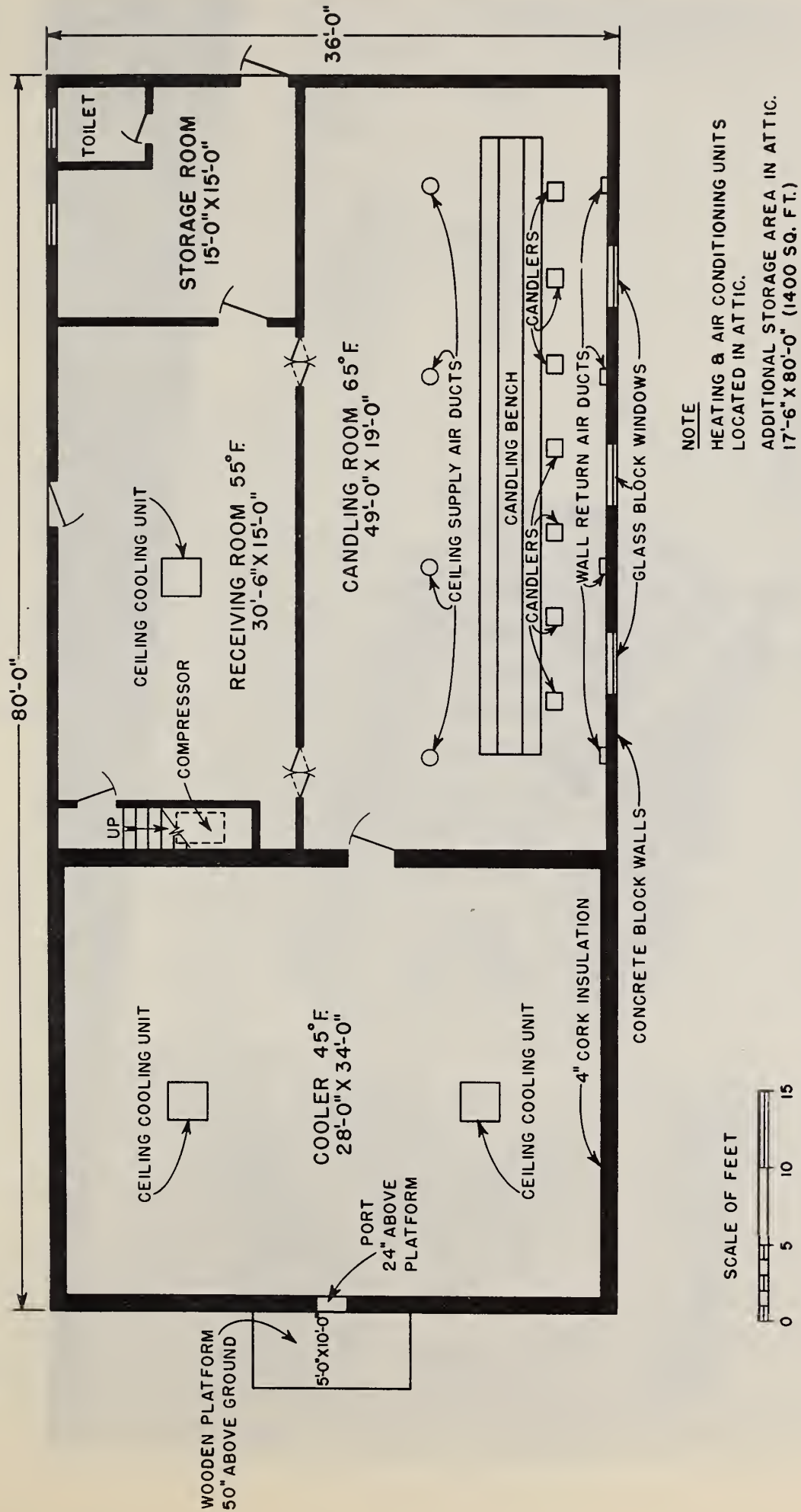


Figure 4.--Layout of an air conditioned egg assembly plant.

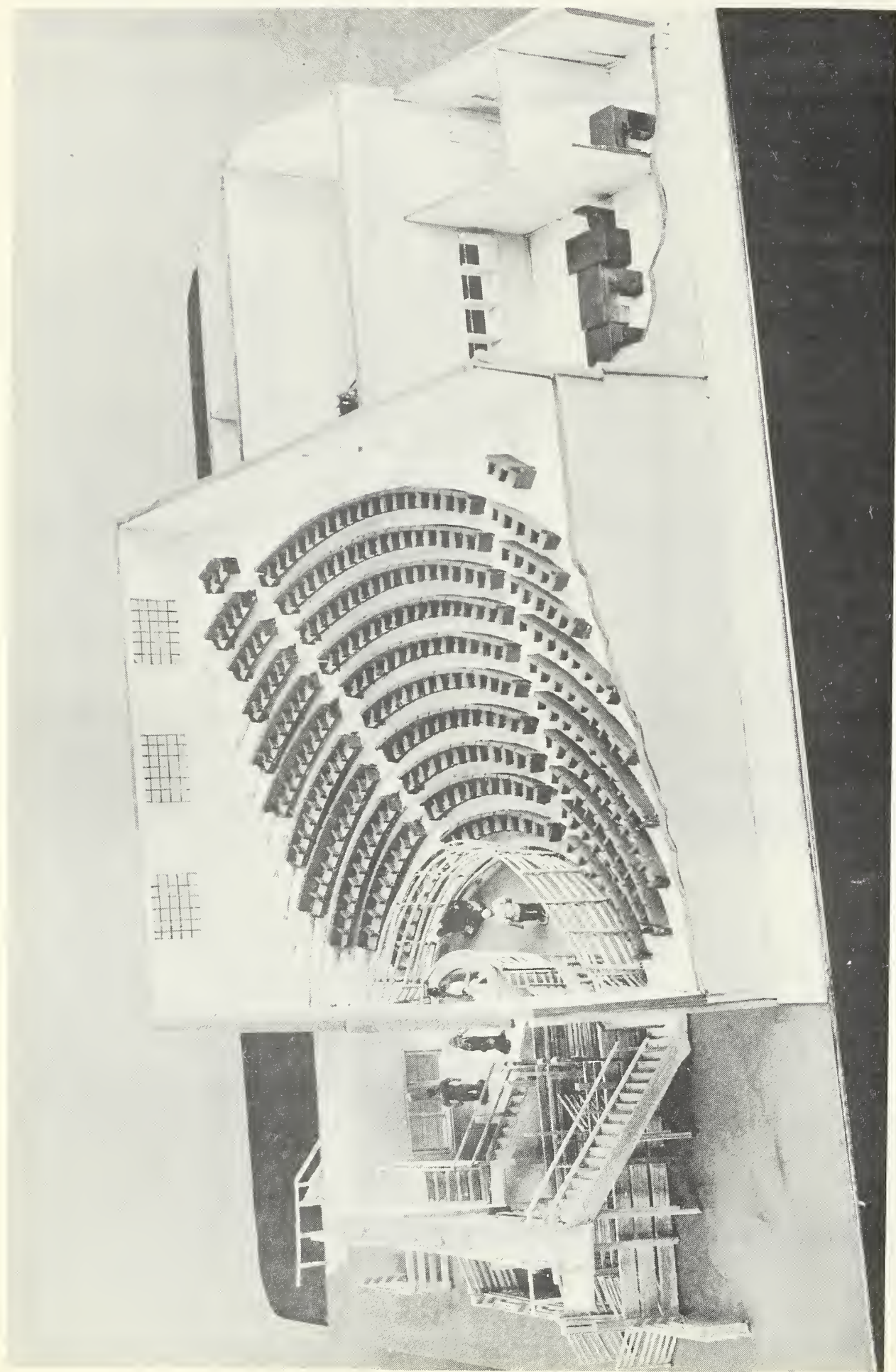


Figure 5.--A cutaway view of scale model of suggested sales barn for a Texas livestock auction market.

four workers. In addition, the suggested facilities and methods would reduce the time sellers wait in line to unload livestock, speed up loading by buyers, make possible a more efficient utilization of pen space, and assure against interruptions in the flow of stock through the selling process.

Work on the second subproject was initiated in February 1953. The objectives of this study are to determine the relationship between the number and types of buyers and sellers on the market by the volume of business done; measure the extent of the area served by auctions and the size of the livestock enterprise by sellers patronizing them, ascertain the economic and physical factors relative to market locations; determine operating costs of auctions by volume of business handled; and to determine the other factors which tend to make auctions successful or going concerns.

A sample of 40 markets was selected for case study. The choice of markets to be studied was based on the total volume handled, species handled, and the geographical location within the State. From the markets, the following data were obtained: The type and number of sellers and buyers patronizing the markets on specific sales days; their volume of sales and purchases and their distances from the market; the size of the livestock enterprises of the sellers; and the 1952 financial operations of the market. Data on the financial operations were obtained from the actual records of the individual markets in order to provide an accurate analysis of the firm's operations. Field work for this project has been completed and the tabulation and analysis of these data were underway at the end of the year. The report will be published during the 1953 fiscal year.

Improved Layouts, Designs, and Methods of Operating Livestock Auction Markets in the Southeastern States

The practices and customs employed in marketing livestock through auction markets in the Southeastern States are, in many instances, different from those in Texas. Nearly all livestock received by motor trucks by markets are unloaded at docks rather than in unloading pens as is the case in Texas. On many markets in the Southeast, livestock are weighed on arrival or just before they enter the sales ring, while in Texas nearly all markets weigh livestock immediately after they leave the sales ring. In some markets, in the Southeast, hogs are graded and weighed on arrival at the market and are sold by grades without being driven through the sales ring. All hogs in Texas are run through the sales ring and are sorted by color, size, and condition in the sales ring or just outside it but none are graded by weight. Consequently the layout and design of an auction market facility, designed for Texas conditions, would not be adaptable to all sections of the Southeast.

In May 1953 the Branch, in cooperation with the experiment stations in many of the Southeastern States, initiated a study of livestock auctions to determine the practices, methods of operation, and designs of facilities which would increase the efficiency of auction markets, and to establish the economic factors which determine the success or failure of auction markets.

Field work was initiated on the project in June and the observations were made of the operations and methods employed in marketing livestock in auctions on the 15 markets selected in Georgia, Florida, and Mississippi. Field work on markets to be selected in Virginia and Louisiana is planned for the fall of the year. It is contemplated that the field work on the first phase of the study will be completed by January 1, 1954.

Improved Order Assembly Room Layouts for Wholesale Frozen Food Distribution Plants

The report *Planning a Frozen Food Distribution Plant*, published in June 1951, pointed the way for frozen food distributors to improve their operations by adopting the best known practices currently in use. However, it was realized that even if all known improvements were applied inefficiencies still would exist. It was therefore evident that if further marked improvements were to be made in frozen food wholesale plants, it would be necessary to embark on a program of research designed to develop new methods, equipment, techniques, and layouts. Twelve wholesale plants were selected for detailed case studies. Work analysis techniques showed rather quickly where inefficiencies in order assembly operations were occurring. For example, the studies indicated excessive time spent in pushing cartons on dead conveyors, considerable waiting time resulting from unbalanced workloads, excessive handling of invoices in assembling orders, inadequate supervision because of night work, and loss of time required in receiving and transcribing orders in the office and transmitting them to the workroom. Analysis also indicated a definite need for improved methods of error control in filling orders. It was learned that improved error controls should be slanted toward reducing man-hours spent in preventing and correcting errors, cutting time spent by salesmen in adjusting accounts, increasing customer satisfaction with company service, and reducing clerical expense. As problems were ferreted out and causes and effects identified, work was begun with design engineers to alter existing types of equipment so that they could be adapted to frozen food handling. In some cases new equipment was designed. By June 1953 new and improved equipment and revised methods had been installed in four pilot distribution plants. Equipment and methods were varied in each plant so as to measure their relative merits.

One of the new systems designed consists of a completely powerized conveyor worktable unit (fig. 6). This system has now been installed in one of the plants selected for case study. The mechanization of the in-movement, order selection, and out-movement of merchandise reduced the warehousing crews from a total of 11 men to 8 men, thus enabling the amortization of the equipment in less than 2 years. In addition, a one-fifth gain was made in the storage capacity of the plant, solely through improvements in stacking made possible by the use of pallet racks.

Another order assembly system involves the use of special push carts which were designed and constructed for use in three plants. Large multiple-shelved push carts (fig. 7) that can be loaded with 10 to 15 orders now are in operation in one Philadelphia plant. Medium-sized single-deck push carts (fig. 8) are in use in a Camden, N. J., plant. These carts can be used to transport 3 to 5 orders. Small single-order push carts are in use at a Roanoke, Va., plant. Cost reduction in push cart installations has not been completely analyzed, but preliminary analysis indicates extremely

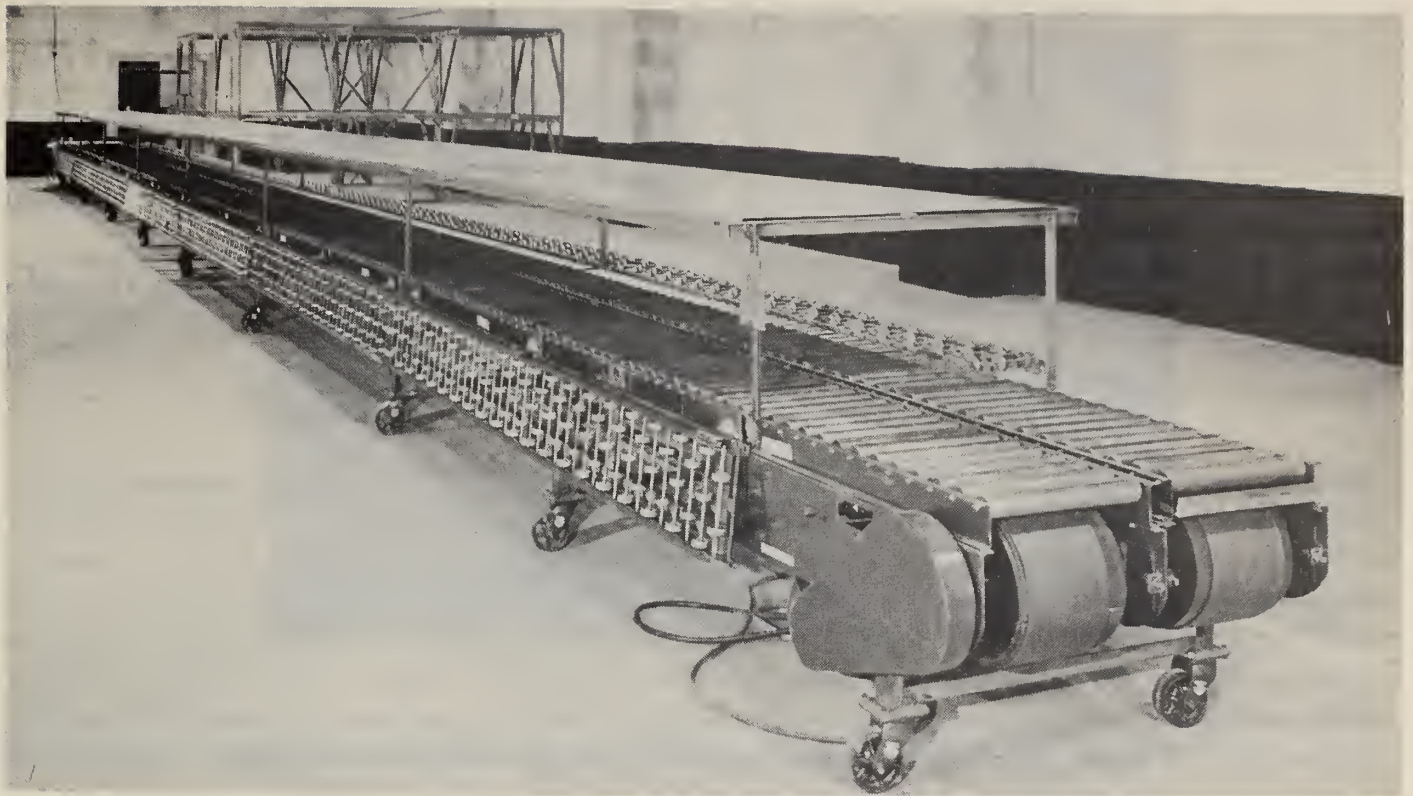


Figure 6.--An order assembly table with live roller conveyors designed for loading frozen food delivery trucks directly from order assembly line. Skate conveyors on each side of the live rollers are used for working surfaces and are hinged so as to permit adequate aisle space for restocking the line.

encouraging results. In Camden, for example, the order assembly crew was reduced from 28 to 18 men; in Philadelphia from 10 to 8 men; and in Roanoke from 3 to 2 men. These push cart installations, like the power conveyor operation, have been installed on case-study bases, and in each instance plant layout has been engineered to suit the experiment involved. In one pilot plant the installation of a mechanical system for recording and transcribing telephone orders and directly transmitting them to the invoice department reduced the number of girls required from 9 to 3.

The results of some of the tests will be published during the next fiscal year. However, as work has progressed, numerous meetings have been held with distributor groups to keep them advised of new developments and to stir their enthusiasm, so that as improvements are made more and more distributors will adopt them into their operations.

Other phases of research in frozen food distribution have been carried along simultaneously with work on order assembly room operations and layouts. Considerable data have been collected on warehousing costs, particularly in regard to private warehouse ownership or leasing as contrasted with the use of public storage facilities. During the year, some research has been done toward developing improved methods of inventory control and systems of providing management with production reports on the work of receiving and order-assembling crews. This research is being conducted in cooperation with the National Wholesale Frozen Food Distributors Association and covers the entire United States.

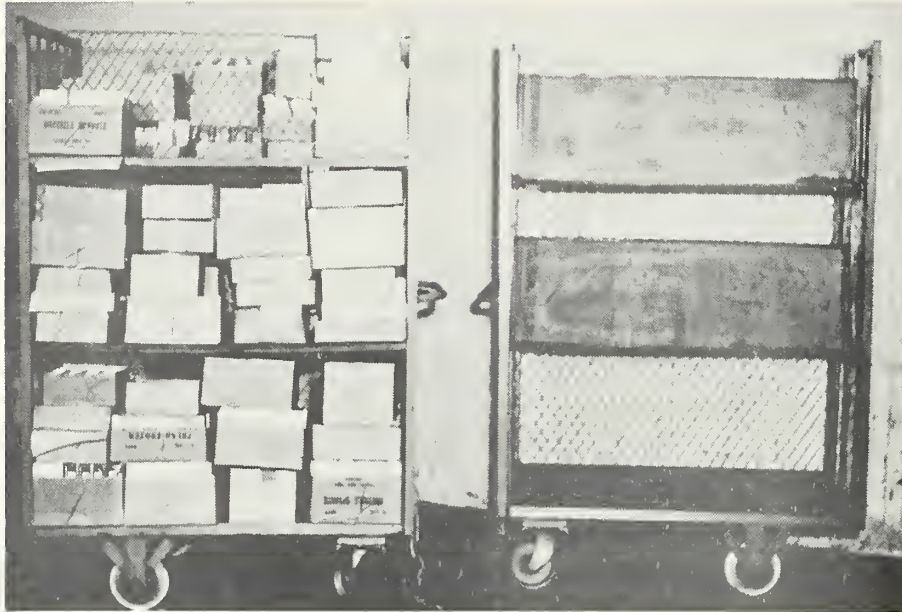


Figure 7.--Push cart designed for use by wholesale frozen food distributors who assemble orders during daytime when delivery trucks are on route. Each cart is divided vertically down the center with a heavy screen, and shelves can be removed or tilted back against the divider. These features permit ready accessibility to each order as it is removed from the cart in route delivery sequence.



Figure 8.--Push carts designed for use by wholesale frozen food distributors who assemble orders at night and load delivery trucks as route orders are accumulated.

Design Principles for Stores and Sales Sheds on Wholesale Produce Markets

Research was undertaken in July 1952 to determine and illustrate the principles involved in designing more efficient store buildings for produce wholesalers and sales sheds for farmers and truckers. Both types of facilities are used in most wholesale produce markets. Field work on this study has been completed, drafts of design illustrating principles have been developed, and a preliminary report has been prepared. This report will be published during the next fiscal year.

Organization, Management, and Finance of Markets

In November 1952 work was initiated on a study of organization, management, and financial structure of markets. One of the objectives of this study is to obtain data on the operating expenses of markets of various types and sizes which will provide a more realistic basis than heretofore has been possible for estimating these costs on new facilities. Such also should, in many instances, enable market managers to find ways of reducing operating expenses. Previous research largely has been limited, because of financial reasons, to the physical layouts of wholesale markets. However, the benefits from a good market layout may be voided if left to haphazard management.

This study goes into the various phases of costs, organization, and management of markets. In doing this job records have been obtained from about 40 wholesale markets. These markets were purposely selected to give representative samples of different types of organizations and locations in all parts of the country. Field work on the report will be completed by November 1953 and the findings should be in draft form by January 1954.

Principles of Layout and Design for Cotton Warehouses and Cotton Compresses

This project was initiated in September 1952 as an outgrowth of materials-handling research in these facilities. Need for the study arises from the fact that since World War II the cotton warehouse industry has experienced a surge of new developments in methods and equipment for handling raw cotton, and many of the existing warehouses do not have the layout and construction features necessary to make most efficient use of these innovations. There is, therefore, a need for some principles to follow in laying out a new warehouse or modifying an old one so that the most efficient and economical methods can be used.

The objectives of the project are to develop principles and data for warehousemen in selecting the location, equipment, methods, arrangement of facilities, storage patterns, size and type of structure, and fire protection system that will produce the lowest over-all cost per bale for handling any particular volume of business.

Specific layouts and designs will be developed to demonstrate the method of assembling the data so that proper selection of facilities can be made for any given set of conditions. The various layouts and designs developed will be evaluated or

compared in terms of the cost per bale to handle a specified number of bales. The comparisons will not include all of the costs of operating a warehouse because some costs are of a local or individual nature (e. g., land, grading, local taxes) and are subject to wide variations. However, three major costs which constitute the bulk of expense, and which can be established within reasonable limits, will be used as the practical basis of comparison between plans. These are: (1) Materials-handling costs, including labor, and equipment ownership and operating costs; (2) building costs, including building depreciation, repair and maintenance costs; depreciation, repair, and maintenance of sprinkler system and other fire protective installations; and (3) cost of fire insurance, which depends upon capacity of storage unit, method of storing, building material, fire protective equipment and other factors.

The determination of materials-handling costs will be the longest and most difficult of the cost determinations because of the large number of combinations of operations, methods, and types of equipment used. A large part of the field work has been completed and the analysis of materials-handling costs is well under way. In this connection the first objective is to establish standard data for all cotton handling operations, both for labor costs and for equipment ownership and operating costs. This information will make it possible to combine elements of work in any desired way so as to determine the time and cost of performing many operations that were not actually observed. Information of this kind will be useful not only for the projects on cotton but also for studies of other commodities that may involve similar operations, and where applicable, will reduce the amount of field work required. All of the elemental operations involved in handling cotton have been defined and the determination of actual time and cost values is in progress.

Progress has also been made in locating sources of information on construction costs and on fire insurance costs. Most of the information needed on current building costs is obtainable from secondary sources. Cooperation has been obtained from several of the leading cotton fire insurance underwriters and underwriting associations for determining the costs of fire insurance on cotton and cotton warehouses for the various States.

MATERIALS-HANDLING RESEARCH

To provide consumers the goods they want, at the time and place they want them, and the services they demand, marketing agricultural products requires the physical handling and movement of millions of tons of commodities each year. In addition, the handling of empty containers and other necessary supplies is part of the marketing process. Some farm and food products are picked up, set down, or handled otherwise as many as 25 or 30 times while they are en route from producers to consumers. At each stage in the marketing channel, beginning at assembly and shipping points and ending with retail stores, products are unloaded from and loaded on the carriers, stacked and broken out of stacks, in moving them into, within, and out of the various marketing and storage facilities through which they move. This handling requires thousands of workers and millions of man-hours of labor. During the period 1950-52, labor costs accounted for slightly over one-half of the total cost of marketing farm and food products. Surveys indicate that, in the aggregate, the industries marketing these products use roughly 40 percent of the total labor employed for materials-handling work. For certain groups, such as public refrigerated warehousemen and wholesale fruit and vegetable distributors, the percentages of the total labor employed for handling work may run as high as 75 or 80 percent.

Furthermore, the costs of labor and equipment are not the only costs involved in handling. Rough and excessive handling causes spoilage, breakage, and deterioration which is a direct marketing cost. Excessive exposure of some products to either high or low temperatures because of slow handling rates also may increase product deterioration.

To handle the increased volume of products needed to supply an expanding population, which demands both additional goods and services, unnecessary handling operations must be eliminated and labor must be provided improved methods and equipment for doing its work, if marketing costs are to be maintained at present levels or reduced. That is, the productivity of labor employed in marketing must be increased just as the productivity of labor on farms has been increased. Meeting this general objective means that plant operators must be provided improved methods for using their present equipment and criteria which can be used as a guide for selecting the proper kinds and amounts of equipment if a change is to be made. This also means that new equipment must be developed for special handling operations where existing types are not satisfactory.

During the past year, studies of handling methods and equipment have been conducted in four different types of marketing and storage facilities: (1) Apple packing and storage houses, (2) public refrigerated warehouses, (3) cotton warehouses, and (4) stores and warehouses of wholesale fruit and vegetable distributors. Studies in apple houses and refrigerated warehouses were conducted under contracts and have been completed by the contractors. Studies of handling operations in cotton warehouses and wholesale fruit and vegetable warehouses were still under way at the end of the year.

Apple Packing and Storage Houses

During the fiscal year 1953, materials-handling research in Pacific Northwest apple packing and storage houses conducted for the Department by the Washington State

Apple Commission under a research contract was completed. The contractor's final report on this work, which covers the results of two years of research, was submitted in September 1952. Consisting of 950 pages, the report presents data from case studies conducted in 17 selected apple packing and storage houses. Studies of selected methods and types of equipment were made in 15 additional plants. By use of industrial engineering and statistical techniques and economic analyses, comparative labor and equipment costs for performing all materials-handling operations associated with moving apples into, within, and out of packing and storage houses were developed and analyzed. Comparative costs also were developed for handling empty containers. These costs are based on man-hours of labor and machine-hours of equipment use obtained through time studies of actual operations. In addition to studying the methods and equipment currently in use in apple packing and storage houses, trials were made with ten new types or combinations of types of materials-handling equipment to determine whether such equipment has possibilities for increasing the efficiency of applicable operations. This report also presents the results of studies made to determine: (1) Amounts of equipment needed to perform most efficiently the handling operations in packing and storage houses, (2) utilization of labor on a plantwide basis, (3) influence of equipment on utilization of storage space, and (4) plantwide materials-handling costs.

Of particular significance in connection with this research was the development of a portable mechanical lift for high-piling and breaking out high piled boxes of fruit in plants that normally use manual methods for performing these operations. One of the lifts, which usually are referred to as *mechanical high-pilers*, now in commercial production is shown in figure 9. Studies show the mechanical high-piler reduces the costs of stacking boxes of fruit in 12-box high stacks about 55 percent below the cost of stacking by the manual method. Costs of breaking out boxes are reduced about 75 percent. A total of 80 Washington State apple houses have purchased one or more of these machines and used them during the 1952-53 season. In these houses annual savings have averaged around \$1,500 per machine.

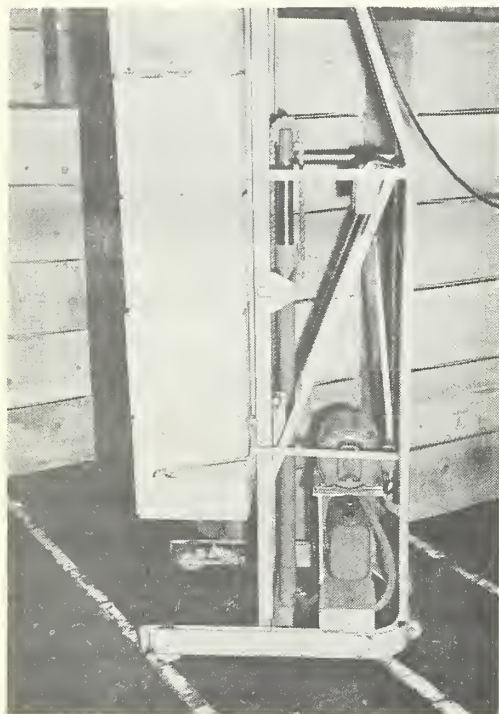


Figure 9.--Single-stack mechanical high piler lifting a stack of six boxes of apples.

Material from the contractor's report will be published by the Branch in a series of five reports which will be summarized in a report written in a more popular style. The first of these reports, *Apple Handling Methods and Equipment in Pacific Northwest Apple Packing and Storage Houses*, which covers an appraisal of methods and equipment for handling both loose and packed boxes of apples into, within, and out of apple packing and storage houses, was published in June 1953. Subjects for four other reports are: (1) Fruit handling innovations, (2) handling empty containers, (3) utilization of space in cold storage rooms, and (4) plantwide materials-handling costs. The first two of these four will be ready to submit for

clearance in the Department by July 31, 1953 and the latter two by December 1, 1953. A report covering orchard handling will be published by the Bureau of Plant Industry, Soils, and Agricultural Engineering.

The report *Apple Handling Methods and Equipment in Pacific Northwest Packing and Storage Houses* presents the following comparative costs per 1,000 boxes for moving fruit into, within, and out of storage houses with specified types of equipment:

<u>Type of equipment and method</u>	<u>Costs</u>	
	<u>Common method : Dollars</u>	<u>Improved method Dollars</u>
Clamp-type 2-wheel hand trucks.	56.03	48.94
Belt conveyors and clamp-type 2-wheel hand trucks	60.28	50.23
Floor chain conveyors and clamp-type 2-wheel hand trucks.	54.62	46.56
Industrial clamp-type lift trucks--24-box capacity.	37.75	35.55
Industrial fork-lift trucks and 48-box pallets	31.99	31.89



Figure 10.--Twenty-four box capacity (1,000 pound) industrial clamp-type trucks are gaining wide acceptance in Pacific Northwest apple houses.

This report also points out that, in the older multistory houses, the 24-box capacity industrial clamp-type truck, such as that shown in figure 10, has possibilities for materially reducing handling costs.

The contractor's final report which includes the accomplishments in providing technical assistance on materials-handling problems to individual plant operators was submitted in June 1953. Detailed reports containing recommendations based on plant studies were made for 24 plants. Providing this assistance generally involved: (1) Drawing up a floor plan of the present facility, (2) calculating labor and equipment costs required in handling apples by various methods, and (3) advising the plant by means of a written report what plant and equipment changes were

recommended as a result of the individual plant study. It is estimated, that, as a result of this assistance, these 24 plants are saving an average of \$5,000 annually on handling costs, or a total of \$120,000.

During the past year, some revisions were made in the movie, *Apple Handling Methods*, which was produced under this contract in 1952. Several scenes were replaced and charts showing comparative data were revised and technically improved. It is estimated that this film was viewed by over 7,500 people during the year.

Public Refrigerated Warehouses

Materials-handling research in public refrigerated warehouses, which has been conducted over a 2-year period by a private engineering research firm under the provisions of an Agricultural Marketing Act contract, was completed by the contractor in June 1953 with submission and acceptance of the final report. In addition to this report, individual plant reports were prepared and submitted to the operators of each of the six plants in which case studies were made. The recommendations outlined in the individual plant reports and their adoption were discussed by the contractor and Department's representatives with each plant operator and the necessary assistance has been provided by the contractor in placing in operation those recommendations with respect to more efficient methods and equipment which were accepted by management.

Data for the reports prepared by the contractor were obtained largely through time studies of labor and machine requirements for handling various types of packages into, within, and out of each warehouse with nine different types or combinations of types of equipment. In making the studies, attention was given to a number of significant variables for the purpose of measuring their influence on the productivity of materials-handling labor. Time studies also were made of revised methods and new equipment recommended by the contractor for the individual plants.

Because of their confidential nature, the six individual plant reports will not be published by the Department. However, the final report rendered by the contractor will serve as the basis for a Department publication covering materials-handling methods and equipment for various kinds of refrigerated warehouse facilities. The manuscript for this publication should be in final form by January 1954.

This research shows that in single-story warehouses, handling by use of industrial fork-lift truck and pallet methods definitely is more efficient than methods involving the use of other types of equipment. In multi-story warehouses, handling pallet loads of merchandise on 4- or 6-wheel hand platform trucks from carriers to stacking points (or the reverse for loading out) and stacking pallet loads by use of industrial lift trucks proved superior to other methods currently used in the warehouses in which studies were made. This research also shows that a rather new development in the materials-handling field, a straddle type fork-lift truck, has application in the refrigerated warehouse industry (fig. 11). This truck operates from a 40 percent narrower aisle than is required for the operation of conventional counterbalanced fork-lift trucks, thus overcoming one of the biggest obstacles to the adaption of pallet handling in some existing refrigerated warehouses.

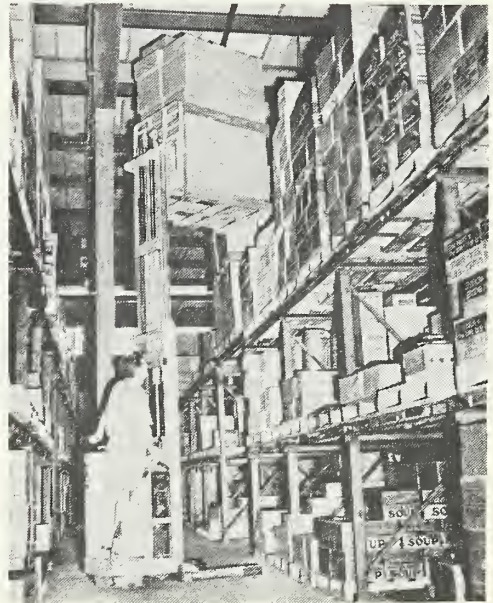


Figure 11.--New type straddle fork-lift truck which can operate in relatively narrow aisles.

Stores and Warehouses of Wholesale Fruit
and Vegetable Distributors

The purpose of this project is to develop data and to determine for all kinds of packages of fruits and vegetables the most efficient types or combination of types of equipment for performing all materials-handling operations in stores and warehouses of wholesale fruit and vegetable distributors. During the fiscal year 1953, emphasis was placed on completing this work as it pertains to bananas. A report covering methods, equipment, and facilities for receiving, ripening, and cutting bananas is being prepared and should be in final form in October 1953. This report will appraise seven different types of equipment used by wholesalers for receiving bananas and for moving them into ripening rooms and to the cutting and packing line. Different types of cutting equipment also are being appraised. Comparisons will be made on the basis of labor and equipment inputs required by various methods and equipment. A number of different layouts will be developed. Comparisons of equipment and layouts will be based on the handling of three different annual volumes of bananas--100 cars, 300 cars, and 500 cars--and on plants that handle bananas only and those that handle other fresh fruits and vegetables. This report also will include a section on the shrinkage losses borne by wholesalers. A discussion will be included on the bruising characteristics of green and ripe bananas.

Field work on this study, which included time studies of the banana equipment and facilities in use in 18 warehouses located in 11 different cities throughout the United States, has been completed in all essential details. These studies serve as a basis for calculating man-hour and machine-hour requirements for performing the various handling operations. Hourly costs for using the different types of equipment have been developed through interviews and other communication with equipment manufacturers. In computing total costs for each method, costs for labor at an assumed average wage will be added to the machine costs based on the hourly rates developed.

On the basis of preliminary analyses, the 4-wheel platform truck with superstructure for hanging the stems of bananas, such as that shown in figure 12, is one of the most efficient types of handling equipment. Equipment ownership and operating costs are relatively low.

After completing work on banana handling, emphasis will be placed on the work relating to other fruits and vegetables. All existing data now on file will be reviewed and summarized to determine what work needs to be done to fill gaps in existing data. It is estimated that by December 31, 1954, the field work and the first draft of the final report will be completed.

In promoting the findings under this project, assistance was given to a number of individual dealers in improving their material-handling operations. Assistance also was given on the design and layout of new facilities which should materially improve the efficiency of fresh fruit and vegetable handling operations.

Cotton Warehouses

Field work performed during the year included studies of cotton handling operations in a number of selected warehouses in North Carolina, South Carolina, Georgia,

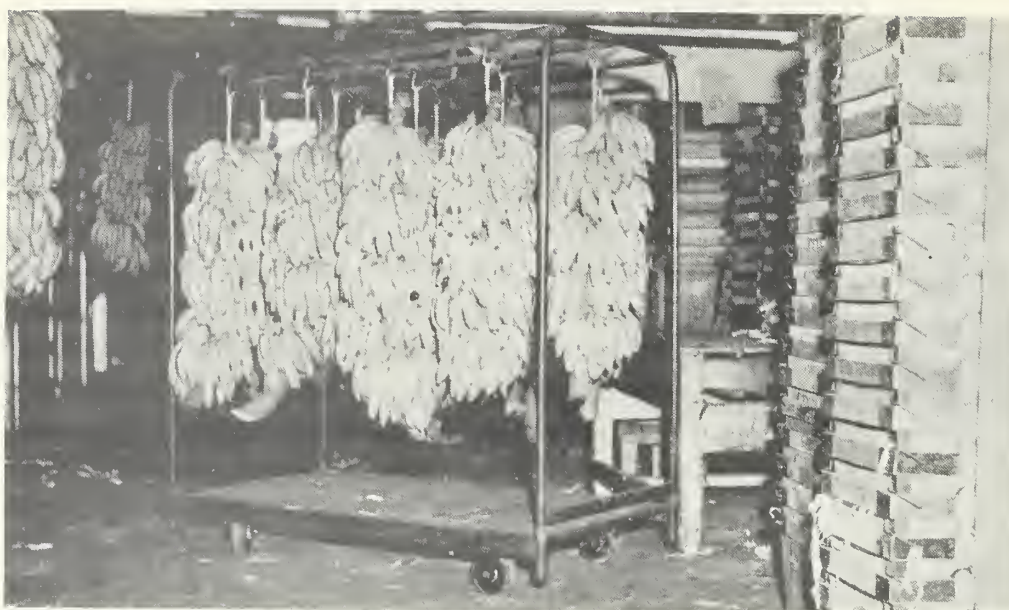


Figure 12.--Four-wheel hand truck with superstructure for handling stems of bananas is one of the more efficient types of equipment for use in receiving operations.

Alabama, Louisiana, Tennessee, and Texas. Among the methods and equipment covered were the use of two types of specially designed breakout equipment, one of which holds considerable promise but requires further development, and the other of which has now been brought to a stage where it merits the attention of many cotton warehousemen. A report in which three methods of breaking out flat bales stored on head are compared--one of which is the newer method using this equipment--has been prepared for early release in the ensuing fiscal year. Among other equipment and methods studied are the uses of 4- and 6-bale capacity lift trucks (figs. 13 and 14) for transporting, stacking, and truck loading, and unloading operations, which offer considerable promise for reducing some handling costs 75 percent below hand truck methods. Another promising method is the adaptation of block sampling methods--an efficient method of sampling heretofore applied only to flat bales--to the sampling of compressed bales. Some of these operations require further investigation.

During recent months much progress has been made in developing bases for the establishment of standard times for work elements in cotton handling operations. It is expected that much of the data thus developed will be useful not only as an aid in evaluating the relative efficiency of techniques and methods for handling cotton which may be introduced in future years, but as an aid which also may be applied--where methods and equipment are similar--to the measurement of efficiency in handling other products or commodities.

In order to make more effective use of some of the continuing equipment cost information being received through the cooperation of several cotton warehousemen, it has been decided to defer publication of the report dealing with preventive maintenance and other equipment problems until 1954.

A report entitled, *Cotton Handling Guide for Warehouse Managers and Foremen*, was published in June 1953. This report suggests to warehousemen techniques by which



Figure 13.--Ground level unloading of flat bales of cotton by two clamp trucks, each handling three bales at a time.



Figure 14.--Six-thousand pound capacity clamp truck handling six compressed bales of cotton in one load.

they can analyze their own handling operations for the purpose of detecting waste and inefficiency, and for planning and instituting more efficient methods. Warehousemen are urged to adopt a critical, questioning attitude toward all their handling methods so that nothing about a method or an operation will be accepted as good simply because it always has been done that way. Examples are given to show how the raising of certain questions about methods that long had been taken for granted led to handling improvements and lowered costs. The chief causes of inefficiency in cotton warehouse handling operations were found to lie in: (1) Failure to make effective use of labor, (2) failure to substitute powered equipment for manual labor, and (3) failure to make effective use of the equipment used. Examples are presented to illustrate how, by the application of some well recognized principles of work simplification and materials handling, such inefficiencies may be reduced and economies in handling cotton may be effected.

It is expected that field work in connection with this will be completed during the 1953-54 season and that following completion of this phase of the research about one year will be required to prepare the final report.

METHODS STUDIES OF PACKING-LINE OPERATIONS

Another group of marketing operations that require a relatively large amount of labor are those involved in preparing products for market. For certain types of products, these operations are referred to as *packing-line* operations and may include dumping, cleaning, sorting, sizing, packing, lidding, labeling, and stamping. As contrasted with materials-handling work, packing-line operations usually are performed at fixed work stations. Moreover, in connection with the former of these groups of operations, products are physically handled in containers or packages, but in packing-line operations the product itself is handled. As a result, rough and excessive handling, by both workers and machines, causes much more damage, in the form of bruises and other injuries, than usually is caused by handling in containers. The spoilage and waste resulting from such injuries amount annually to millions of dollars. In addition, consumers receive products of lower quality and this deterioration does not show up as an item of marketing costs.

The total amount of labor required for performing packing-line operations is indicated by the results of a study made in California apple and pear packing houses of grading costs. It was found that this job alone accounts for 25 percent of all hourly rate labor employed and 15 percent of total labor costs.

The general objective of research in this field is to develop improved methods and equipment for performing packing-line operations so as to reduce: (1) Labor requirements for performing these operations, (2) losses from spoilage and deterioration, and (3) the investment in packinghouse facilities.

One study in this general area was completed and a second study was initiated during the past year. The first of these studies covered research on problems in connection with the visual inspection of products for surface characteristics in grading operations. The second covered the development of improved methods and equipment for grading, sizing, and packing apples.

Visual Inspection of Products in Grading Operations

Studies show that grading belts or tables, over which a number of types of products are run for sorting, are, in many cases, run at speeds which do not permit the inspectors (graders) to see the product for the proper length of time. Most belts also move too large a volume of products past the inspector at a given moment. Moreover, most grading belts make no provision for rotating the product as it is moved past (translated) the inspector so that the entire surface will come into view. This frequently makes it necessary for the inspector to pick up individual items and turn them in his hand, thus increasing the basic motions required in performing the operation. The result is that, to maintain the desired outgoing quality or accuracy of inspection, additional inspectors usually are stationed at the table to double or triple check each item when one inspection, if properly made, should be adequate. Reports from citrus fruit packinghouse managers also indicate that when belts are run at certain speeds, the inspectors may develop a form of nausea or *white out* which does not make them incapable of seeing the fruit but does make them incapable of making decisions and performing the labor involved.

In designing research to increase the efficiency of grading operations, it was obvious that before improved methods, including improvements in equipment, could be developed basic data were needed to answer the following types of questions. Based on the skill of average packinghouse workers, how long must the eye see products of different sizes, shapes, and colors before a classification of individual items can be accurately made? Should the entire surface of each item come into view? If so, how often should it come into view during the period of translation? How many rows of the product can the human eye see at one take?

Research designed to provide such data was completed during the past year by the University of California's Institute of Engineering Research under an Agricultural Marketing Act contract.

To check the validity and applicability of laboratory data obtained by use of wooden objects simulating various types of fruits and other products, tests were made in commercial plants on the grading of lemons, oranges, and white potatoes. In these tests, the experimental grading table used in laboratory work was moved to the packinghouses selected since variable speeds of translation and rotation could not be obtained through use of regular packinghouse equipment. Packinghouse workers were used to perform grading operations with the experimental table and official Federal-State inspectors were used to check the quality or accuracy of the grading operations on both the experimental and regular packinghouse methods.

In tests with lemons where the proper speeds of translation and rotation were used and the proper number of rows of fruit were moved past the inspector, the man-hours of labor required for grading a given volume of fruit were reduced 75 percent below that required on the grading belt in the plant where the tests were made (fig. 15). Tests with oranges showed a 67 percent reduction in labor requirements. Both lemons and oranges were sorted for three grades--choice, standard, and juice--plus culls. In tests with white potatoes, which are sorted for one grade plus culls, a saving in labor of about 10 percent was shown. Outgoing qualities on the test tables were matched with those from the house belt.

The report on this project entitled *Visual Inspection of Products for Surface Characteristics in Grading Operations* was published in June 1953.



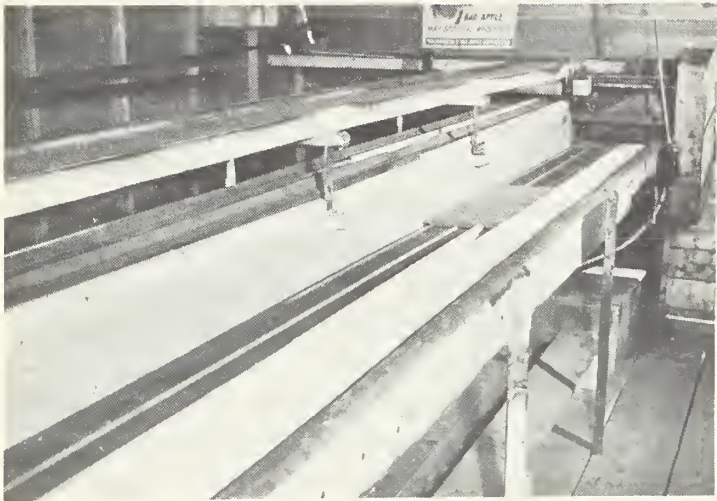
Figure 15.--Grading table designed for laboratory tests is being used in packinghouse test for grading lemons. When lemons were moved past grader at proper speed and properly rotated as they were translated, labor requirements were reduced 75 percent. Outgoing qualities on test table and house belt were matched.

Improving Methods and Equipment for Sorting,
Sizing, and Packing Apples

This research was initiated in November 1952, under a contract with the Washington State Apple Commission, for the purpose of checking the performance of currently-used methods and equipment and to develop plans and specifications for improved equipment. In checking the performance of sorting tables currently used in Washington State apple houses, studies were made of the comparative labor and equipment costs by use of three types of equipment: (1) Belt-type sorting table (fig.16), (2) spiral-roll table (fig.17), and (3) reverse-roll table (fig.18). These studies showed that the reverse-roll table, which rotates the fruit as it is moved past the inspectors, has the greatest possibilities for effecting economies in the use of sorting labor. Accordingly, work was undertaken to improve this table. Improvements made consisted of dividing the table into lanes and assigning responsibility to individual graders for certain lanes. Variable speeds of translation also were provided by use of a variable speed motor. Although these revisions reduced labor requirements, this research corroborated the results of visual inspection work with respect to the need for variable speeds of both translation and rotation.

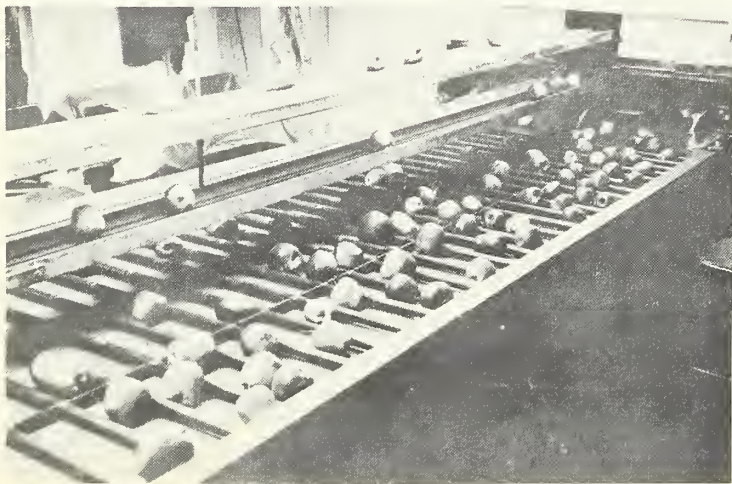
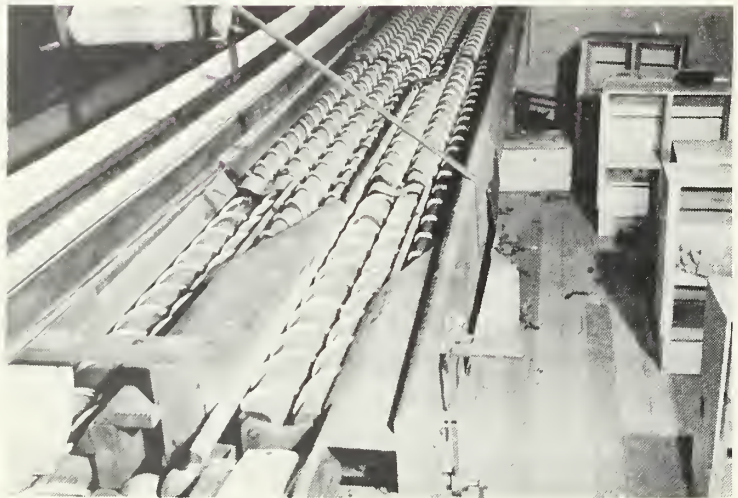
As a part of this research evaluations have been made of the amount and severity of bruises, stem punctures, and mechanical injuries caused by or in connection with current methods and equipment for sorting, sizing, and packing apples. These data will provide a basis for making comparisons of injuries caused by new methods and equipment.

During the 1953-54 season it is contemplated that prototypes of sorting and sizing tables and an accumulator, which will provide a new packing station, will be constructed and tested under actual operating conditions. Data from these tests will be compared with similar data on currently-used equipment to determine whether improvements have been made.



*Figure 16.--Belt conveyor sorting line.
Fruit is not rotated as it moves past
graders.*

*Figure 17.--Spiral-roll sorting table.
Ropes on rolls both rotate and
translate fruit.*



*Figure 18.--Reverse-roll sorting table.
Rolls rotate fruit in same direction
of translational movement.*

AN ANALYSIS OF THE COMPONENTS OF WORKER PRODUCTIVITY IN AGRICULTURAL MARKETING OPERATIONS

The purpose of this project is to determine the degrees of skill and effort involved in individual basic motions, to classify them accordingly, and to establish standard time values for basic motions involved in agricultural marketing operations. Such data are needed to improve the accuracy and utility of efficiency studies of agricultural marketing operations. This research is being conducted for the Branch by the New York State College of Agriculture under the provisions of an Agricultural Marketing Act contract.

Standard time values are being developed for a wide variety of basic motions used in agricultural marketing work. Such motions were identified and selected on the basis of a preliminary field survey of diversified marketing operations. Work motions involved in nailing crate lids, wrapping apples, and handling single objects large enough to require both hands were added to the large number of operations reported in last year's progress statement. This catalogue of operations now comprising approximately 3,300 feet of 16 mm. film is essentially complete.

During the year, data were obtained and analyzed for a large number of subclasses of motions. At the end of June 1953 it is estimated that 75 percent of the final number of subclasses of motions have been photographed and analyzed although tables from these data have not yet been prepared. The latest inventory reveals that 109 subclasses of motions have been photographed and microanalyzed. Each of these 109 subclasses covers a minimum of 15 operators at 20 cycles per operator. Many of these subclasses do not reveal performance time differences which would justify their segregation in the final tables. Time values for such subclasses will be combined in the final tables with an adequate description of the motions. For example, the complete cycle time in stocking grocery shelves with 4 can sizes revealed performance time (in 0.0005 minute) of 39.4, 40.0, 39.2, and 44.6 for 11, 20, 33, and 56 ounce cans, respectively, so that the first three can size values logically could be combined into one subclass of motions. It is estimated that at least 80 percent of the work in measuring standard time values for subclasses of motions has been completed.

The progress report for the year ending June 30, 1952 indicated that the arithmetic mean proved to be the best choice among the various measures of central tendency for purposes contemplated in this project. Work during the past year has revealed no reason for altering this conclusion.

An investigation has been made concerning the desirability of showing, in the final tables, the distribution of the data as well as the mean values. Two motions whose arithmetic means are equal (or nearly equal) often vary widely when comparisons are made of the individual values which make up those means. Consequently it has been concluded that the final tables should show for each subclass of motion both the mean value and the distribution of values about the mean. The distribution can perhaps be shown best in units of the standard deviation.

Average times have been computed for all of the subclasses of motions photographed and analyzed thus far. These data are being subjected to matched-pair analysis to determine which factors have a measurable effect on performance time,

and also to determine the most feasible class intervals for factors such as weight and distance. This analysis is for the purpose of fitting together the actual data into an integrated table. As pointed out, a few subclasses of motions which are not significantly different in performance time are being combined into one subclass and in other instances interpolations are being made between the averages obtained from actual data. All interpolated data will be identified in the final tables.

The matched-pair analysis has revealed instances where separate subclasses must be established for factors which could not be anticipated when this work was initiated. For example, the position release of eggs in a filler which followed a simultaneous grasp of two eggs took an average of 36 frames (1 frame = 0.0005 minute) while the same motion following a consecutive grasp of two eggs took only 28 frames. This result is logical in view of the fact that more prepositioning can be done during a consecutive grasp. However, the significance of factors such as this cannot be foreseen without examination of the data.

Several significant variables have been revealed which have not been included in any one of several sets of predetermined motion time tables compiled for industrial work. For example, multiple grasps in which more than one object is grasped at a time is very common in agricultural marketing but these are not recognized in industrial tables. Other examples encountered are one-hand vs. two-hand work which is being carefully measured for standard time under varying circumstances. The time required for workers to make decisions is another consideration being treated in the tests as well as measurement of the effect on performance time of preceding or succeeding motions. As a result the final tables developed are likely to be rather complex but at the same time this indicates that the developed tables reflecting these factors will prove to be a more discriminating tool than originally anticipated for use in appraising the effectiveness of alternative work methods.

The motion reach was selected earlier for correlation with other motions which occur in the same cycle as a measure of the influence of effort on the particular motion. Correlations have been computed for slightly more than half of the data obtained thus far. During the period covered in this report the first correlations were made which were based on the complete sample of 15 operators and 20 cycles per operator. These correlations show considerably more stability than earlier test runs made on a smaller sample base. The general pattern was the same as with the smaller sample, i. e., move showed the highest correlation, grasp an intermediate degree of correlation, and position the lowest. However, the correlations based on the larger sample seem to be considerably more sensitive to small changes in the motion subclass. It is estimated that this phase of the work is 40 percent completed.

Actual performance time is yet to be compared with the table data. An attempt was made in September (1952) to run a test of the data on apple packing. The films were discarded before analysis because the plant owner had obviously influenced the packer. This test or a similar one will be redone during the coming apple season and another test will be conducted in stocking grocery shelves at one of the local stores.

The frequent and random changing of motion patterns which appear normal in agriculture is believed to be one of the chief causes of inefficiency in agricultural

marketing operations. It is not necessarily best to follow one motion pattern continuously, but too frequent changing does not permit either the attainment of automaticity of movement or the development of rhythmical motions. This has been detected through observation of the large number of experienced agricultural workers who have been studied in this project. Another somewhat related observation and perhaps equally important is the common lack of instruction of workers. No amount of experience at a task seems to provide a satisfactory substitute for proper instruction. This conclusion is based on the observations of many workers in the laboratory and upon the rapid improvement in output of these workers when they are carefully and effectively instructed in the performance of their assigned task.

This project will be completed by June 30, 1954. To accomplish this it is planned to identify the additional subclasses of motions necessary to complete the standard time value tables, do the necessary filming of operators, and analyze the film. Special attention is to be given to such factors as fragility, perceptual requirements, and decision in rounding out the information already obtained. The tables will be prepared showing the standard time values expressed as arithmetic means together with the standard deviations which will be computed for each value. The data obtained will be subjected to matched-pair analysis in order to determine which values will be combined in the summary tables of values. This will eliminate needless detail from the final tables and give them greater utility. Correlations of the standard time values for each subclass of motion will be computed and completed in order to assign effort and skill ratings to each value. The completed tables will be subjected to several tests of application to selected agricultural marketing operations. These tests of application will include both written and personal instruction in order to determine their relative effectiveness. Instruction will be developed and guides prepared for the use of photographic techniques and equipment for conducting motion and time study work. The work will be completed with the preparation of a final report.

TRANSPORTATION FACILITIES, EQUIPMENT, AND LOADING METHODS

Increased freight rates for the transportation of agricultural commodities, coupled with generally lower farm prices, have intensified the search of producers and shippers for more economical and efficient ways to get their products to market. Transportation research programs of the Branch during the year included: (1) Work to improve the services and obtain better utilization of carrier equipment; (2) the study of equipment to provide better protection for the product at lower costs; and (3) research in methods of stowing, bracing, and shipping, to reduce loss and damage in transit and lower the costs of loading, unloading, and bracing shipments.

IMPROVED TRANSPORTATION FACILITIES AND EQUIPMENT

A major portion of the equipment research work of the Branch during this year has been in the motortruck-trailer field where there have been rapid developments in the introduction of new types of equipment and improvements in some of the existing types. Further, with the increasing use of motortrucks and motortruck-trailers in the transportation of perishable foods, a number of problems have arisen which have required study.

Refrigerator Cars

In the railroad equipment field the number of mechanical refrigerator cars in use has been increased, with approximately 200 mechanically equipped cars now in service and an additional 250 cars on order for delivery within the next 6 to 9 months. Two new types of mechanical refrigerating units for refrigerator cars have been developed and at the close of the fiscal year were being incorporated in cars for experimental purposes. As soon as these cars are available, it is planned that transportation tests of their efficiency will be made for comparison with the mechanical refrigeration systems now available.

Refrigerated Motortruck Equipment

In the report for the fiscal year 1952, reference was made to tests of a new type of motortruck refrigeration using dry ice as the refrigerant. That unit, consisting of a dry ice bunker with a finned surface, was installed in the front end of a 30-foot heavily insulated truck-trailer. The circulation of air through the bunker was thermostatically regulated to control the degree of temperature desired. Studies made of that unit indicated that the performance was not entirely satisfactory. The dry ice bunker, with a capacity of approximately 600 pounds, did not prove adequate to maintain the zero temperature desired for the protection of frozen foods and supplementary amounts of dry ice had to be added in the body of the trailer during the transportation tests. Accepting our suggestion that the capacity of the unit be increased, the manufacturer constructed a larger cabinet which contained approximately 50 percent more capacity than the old unit.

Three tests were made of the improved equipment during this year. In two trans-continental tests, the outside temperatures ranged from 52° F. to 98° F., and from 70° F. to 95° F. on a test from Florida to Jersey City, N. J. Performance was felt

to be greatly improved over the unit previously tested, the average rise in temperature between the time of loading and unloading being approximately 5°. As the temperature of the frozen product at the time of loading was below zero, average commodity temperatures upon arrival were only slightly above the zero mark. The results of these tests are reported in *Refrigeration Tests of a Motortruck-Trailer Equipped With One Type of Dry Ice System of Refrigeration*, April 1953.

A further study was made of the efficiency of this system of refrigeration in the transportation of fresh and frozen meat by motortruck. Two separate tests were made, the conditions requiring different degrees of protection for the meat, and under different ambient temperatures. In the first test, on a load of hard-frozen pork bellies across the southern part of the country, relatively warm temperatures were encountered. A product temperature of 20° to 22° F. was required. Loaded at a temperature of 22°, the average temperature of the product was found to be 20.4° upon arrival at destination. Hourly consumption of dry ice was approximately 24 pounds.

On the second test, with chilled beef quarters, made from South Bend, Ind., to Brooklyn, N. Y., in relatively cool weather, the product, loaded at a temperature of 39° F., was found to have an average temperature of 32.2° at destination. Dry ice consumption was approximately 14.5 pounds per hour on this test. (*Tests of One System of Dry Ice Refrigeration in the Transportation of Meat by Motortruck-Trailer*, June 1953.)

Another new refrigeration system for a motortruck-trailer using dry ice as the basic refrigerant but employing a secondary refrigerant and cooling coils mounted along the ceiling of the trailer was also studied. In a transportation test run from Florida to Philadelphia, Pa., in September 1952, with frozen citrus concentrate as the lading, there was an average rise in production temperature of 2.3° during the transit period. This is reported in *Test of a Refrigerated Truck-Trailer Equipped with a Dry Ice System of Refrigeration Using a Secondary Refrigerant*, April 1953. At the close of the fiscal year the manufacturer was rebuilding this unit and incorporating some new ideas intended further to improve its efficiency, and tests of the improved unit are planned to be conducted early in fiscal year 1954.

There have been differences of opinion among frozen food processors and among motor carrier operators as to the effectiveness of protecting frozen foods in transit by distributing dry ice on top of a load. In order to throw light on this debated question, a transportation test was arranged in which three trailers loaded with frozen food were observed. All of the trailers were of a standard type comparable in construction and with six inches of insulation. One was equipped with a mechanical refrigerating unit and had the customary floor racks and side wall strips to provide for the circulation of air around and under the load; the second trailer had the same type of refrigerating unit but a return air duct was installed in the nose of the trailer and greater clearance for the movement of air was provided under the load and at the side walls; while in the third the refrigeration was supplied by blocks of dry ice placed on top of the load from front to back of the trailer with additional blocks on the floor at the rear door of the trailer, a total of 1,632 pounds. Additional dry ice was added in transit.

The third trailer, in which dry ice was used, not only showed a wider spread in temperatures between the top and bottom of the load but also had higher average commodity temperatures at the time of unloading than did the mechanically refrigerated units. The modified trailer with the return air duct had the most satisfactory temperatures in both range and average. (*A Test Comparing Dry Ice and Mechanical Refrigeration in the Transportation of Frozen Citrus Concentrate by Motortruck*, February 1953.)

A test on a truck-trailer equipped with a relatively new type of refrigerating unit was made in November 1952, in connection with the movement of a load of frozen turkeys from Modesto, Calif., to Medford, Mass. The mechanical unit was located under the heavy-duty 35-foot trailer, which had six inches of insulation in the walls, ceiling and floor. The evaporator coil and air-circulating fans were built in the front end of the trailer. Wall strips and aluminum floor racks were also provided. The results of this test were somewhat unusual. Because of a breakdown of the tractor at St. Louis, Mo., on the eastbound trip the load was in transit for 12 days, at the end of which time the average product temperature at the time of unloading was found to be -13.4° , a rise of only 2.6° from the temperature taken after loading. Experience has demonstrated that the lower the temperature to be maintained the more difficult it becomes to provide it. While the results of this test seemed to be exceptional, the fact that it was made during the cooler weather of late fall must be taken into consideration. The work is reported in *Test of a Mechanical Refrigerating Unit Designed to Maintain Low Temperatures in Motortruck Transportation*, March 1953.

Several additional tests of this particular type of unit were made in May 1953, the results of which had not been released at the close of the fiscal year.

In conducting transportation tests of the refrigerated equipment described on these pages, Branch personnel ride the tractor-trailers under test. Twelve electric-resistance thermometers connected by cables to an outlet on the exterior of the truck are placed at various positions in the load or suspended in the body of the trailer so that the temperatures at the critical, as well as the noncritical, points may be observed (see fig. 19). The electric-resistance thermometers used to take commodity temperatures are inserted directly in the product. A special reading instrument enables the observer to check the commodity and air temperatures at each point within the trailer at frequent intervals without having to open the trailer doors to do so.

The best time to study and measure the efficiency of refrigerating units is during the warm months of late spring, summer, and early fall. Additional tests which have been made during May and June 1953, and which have not yet been reported, include tests on the transportation of fresh meat from Texas to Los Angeles, Calif.; and Chicago, Ill., and fresh poultry from the eastern shore of Maryland to midwestern destinations.

The Problem of Condensation

When low temperatures are required for the refrigeration of highly perishable or frozen foods, condensation becomes a major problem. In the motortruck trailer this problem takes the form of entry of water vapor into the insulation of the side



Figure 19.--Research technician draping thermometer drops to cable connecting with reading instrument on outside of trailer. After the trailer doors are closed the technician may obtain the temperature in the load from the outside lead.

walls, floor, and ceiling, where it condenses upon contact with the cold wall of the trailer lining. As the amount of precipitated vapor builds up, the insulating material used in the side walls and the wooden structure of the framework within the walls becomes saturated. This not only tends to lessen the efficiency of the insulating material and permit greater heat transference to the inside of the trailer but it also may add a considerable amount of weight to the trailer itself, thus cutting down the payload that may be carried within the legal weight limitations of the various States. At the March 1953 meeting of the Transportation Advisory Committee of the Department, a recommendation was made that research be undertaken in an endeavor to find ways of minimizing this buildup of condensation in the trailer body.

In response to that recommendation, manufacturers of insulating materials, truck-trailer manufacturers, the Truck-Trailer Manufacturers Association, and the American Trucking Association, as well as a number of the larger carriers of frozen foods, were contacted. These companies and organizations displayed extreme interest in the problem. Preliminary plans are being discussed for a program of research, the technical part of which would be conducted by the Bureau of Standards, Department of Commerce. The Bureau of Standards has facilities available for the carrying out of laboratory tests and personnel trained in the field of refrigeration research, who, it is understood, might be made available for such a project. At the present time a survey is being made in cooperation with a limited number of operators of refrigerated truck-trailers engaged in transporting frozen foods in order to determine the rate of

buildup of weight due to condensation and the total amount of added weight that may be reached at the point of complete saturation. The cooperating carriers will make and report the results of periodic checks of the weight increase in new dry trailers resulting from their use over the period of a number of months.

Handbook for Truckers

Work on the assembly of data for the publication of a handbook for truckers, mentioned in our report for fiscal year 1952, has been finished and the handbook will soon be submitted for publication. Undertaken at the request of the motor carrier industry, it is intended to convey to motor carrier operators and truck drivers in simple, understandable form, information they should know about the protection of meats, eggs, frozen foods, fresh fruits and vegetables, and other commodities while in transit, with supplementary advice as to the proper equipment to use, means of providing adequate air circulation, efficient loading methods, and other matters relating to the handling and transporting of perishable shipments.

Livestock Losses

Upon recommendation of the Transportation Advisory Committee, research has been undertaken by the Department aimed toward the reduction of losses and damage to livestock moving to market. There are two phases of this work. The first, to be carried out by the Farm Credit Administration and the Extension Service, is to obtain and disseminate factual information relating to the incidence of losses and causes of injury or death of the animals, with recommendations for the practices which may be followed to reduce those losses. The second phase, the responsibility of this Branch, is for research into means of improving the railroad and motortruck equipment in which the livestock is hauled so as to minimize transit injury. It is well known that slippery car or truck floors, which permit the animals to fall and be trampled or smothered, is one of the principal causes of death or major injury.

The Branch, through the Asphalt Institute, has obtained a supply of a flooring product claimed to have nonskid properties. At the close of the fiscal year, this product was undergoing preliminary testing to determine the worthiness of the material for the extensive study of its usefulness under actual conditions of transportation service. The product has been applied to the floor of a livestock weighing scale in the public stockyards at Columbus, Ohio; to the floor of a killing room in a packing-house at Cleveland, Ohio; to the floor of a railroad stock car; and an installation is being arranged in a motortruck-trailer. Preliminary observations indicate that it probably has adequate nonskid properties; but its ability to stand up under the severe conditions of livestock transportation is not known. The product may have to be altered when the preliminary tests are concluded, or other products tried.

Livestock Conservation, Inc.; various humane societies, the Livestock Loss Prevention Association of Ohio, the Truck-Trailer Manufacturers Association, individual railroads, motortruck operators, trailer manufacturers, stockyards, and meat packing companies, are cooperating in the project, as well as the Asphalt Institute and its members.

Utilization of Carrier Equipment

In July 1950 the railroads announced a program to increase the freight car fleet to 1,850,000 cars by January 1954. As of June 1, 1953, the fleet had been increased by 42,827, or 83,025 cars short of the objective. During 1952 only 63,748 new cars were placed in service against 58,779 old cars retired, a comparatively negligible gain of 4,969 cars. This result was anticipated and reported in the last annual report of the Branch. The deficiency makes necessary continued cooperation and increased efforts on the part of shippers and railroads to obtain maximum utilization of all freight cars; in particular, to accelerate turnaround time by faster schedules, reduction of loading and unloading time, and eliminating excessive terminal delays. Terminal delay is the major obstacle to more impressive improvement in transit time. The problem becomes complex by requiring extensive coordination of schedules between connecting lines, meeting shippers' schedules, provision for reconsignments, and complying with employee working rules. Notwithstanding this complexity, many railroads made adjustments last year in through freight schedules, some as much as 16 percent reduction in over-all transit time. Perishable freight schedules from the Pacific Coast to Chicago were reduced from seventh to sixth morning delivery in July 1952, and a special perishable service on what is almost a passenger train schedule (62 hours) was inaugurated from California to Chicago in May 1953.

The Branch has continued to work with a committee of the American Railway Engineering Association to which has been assigned the problem of developing methods to improve transit time. The A.R.E.A. is affiliated with the Association of American Railroads, specifically responsible for conducting research in the economics of operations, and to recommend improved standard practices. These standards are then published by the A.A.R. in a *Manual* which has for several decades influenced the types of facilities and methods employed by railroads in this and many foreign countries. Branch personnel have worked with the assigned group in analyzing the results of several surveys and spot checks made at large terminals by individual cooperating railroads. The results were the basis for a report to the annual A.R.E.A. convention in March 1953. A member of the Branch staff participated in preparing the report. It was decided at this convention to conduct more extensive surveys, similar to the *movement ratio* idea originally suggested by the Branch, mentioned in previous annual reports, and one such survey was under way by cooperating railroads at the close of the fiscal year.

IMPROVEMENT OF LOADING, BRACING, AND SHIPPING OF AGRICULTURAL COMMODITIES

The economic and monetary losses to carriers and to shippers of fragile and perishable agricultural commodities through injury in transit has been a matter of concern to the agricultural industry, particularly because losses from this source have tended to be substantially higher in post World War II years than in the years preceding the conflict. Research experience has demonstrated that a considerable part of this waste can be eliminated through the adoption of improved methods of loading, bracing, and stripping shipments of these products--an active field of work of the Branch. Container design and construction, as they are related to efficient loading patterns and methods, are also studied.

Lettuce from California and Arizona

The annual report of the Branch for the fiscal year 1952 mentioned research work carried out in cooperation with the Western Growers Association of Los Angeles, Calif., under a contract with that organization which represents California and Arizona vegetable and melon growers. Under one of the projects carried out through this contract a new wooden container for ice-packed lettuce and carrots was developed which became known in the trade as the *WGA crate*. A final report summarizing the research which led to the development of the crate and the study of loading methods applicable to the new container including transportation tests for the study of the protection afforded to lettuce by the use of varying amounts of ice in the crate, was completed and published during the year. (*Reduction of Loss, Damage, and Transportation Costs in Package-Iced Shipments of Lettuce and Carrots*, May 1953.) The newly developed container almost entirely replaced the three other wooden containers used for the shipment of lettuce and carrots during the first year of its use. At that time, practically all the lettuce shipped from California and Arizona was packed in wood or wirebound veneer crates. However, the development of the vacuum cooling process, which permitted lettuce to be shipped without crate or body ice, also presented the opportunity of using cheaper cartons of fiberboard for lettuce shipments. Fiberboard container manufacturers, in designing fiberboard containers for lettuce, standardized upon container dimensions adapted to 2- and 2½-dozen size packs instead of the 4- and 5-dozen size containers which had been standard in the lettuce industry up to that time. The fiberboard cartons ordinarily are packed in the field and either precooled in established vacuum cooling plants or loaded directly into refrigerator cars where they are mechanically precooled before shipment under bunker ice.

This development was most disturbing to many established lettuce producers and shippers. Did lettuce shipped in cartons reach destination with less mechanical injury and loss? Did it actually bring about substantial savings in shipping costs? The industry lacked factual data, as determined through an objective study of the problem. Consequently, during this fiscal year a substantial part of the work carried out under the contract with the Western Growers Association was devoted to an appraisal of the costs of packing and shipping lettuce in ice-packed wooden crates versus field-packed fiberboard containers; together with a series of transportation tests to determine the relative amount of bruising and decay to lettuce in transit when shipped in the respective containers. The field work on this study was completed at the close of the fiscal year and a report was being prepared.

On-End Loading of Cantaloups

Research on the relative advantages of the on-end method of loading cantaloups, compared with the conventional method of loading the cantaloup crates on sides, lengthwise of the car, was completed during the year and a final summary report of the studies of the three previous cantaloup shipping seasons entitled *Loss and Damage in the Transportation of Cantaloups 1950-52*, was published in May 1953.

Upon finding that container breakage was only about one-third and bruising of melons in unbroken crates about one-half as heavy when the on-end method was used

and that substantial savings may be made in loading and refrigeration costs, the on-end loading method was recommended for cantaloup shipments. It was estimated that the use of this method would result in savings to shippers and carriers of more than 2 million dollars per year.

Effect of Top Ice on Container Breakage in Shipments of Vegetables

For many years it has been the custom for shipments of leafy vegetables to be top iced at the time of loading. Sometimes they are also re-top-iced in transit. When top ice is used the containers are placed in the cars with spaces (channels) between rows running lengthwise of the car. After all the containers are loaded in the car the top ice, finely crushed, is blown over the top of the load--particular effort being made to fill all the channels. When this is done, the top of the load is covered with a blanket of powdered ice ranging from 12 to as much as 24 inches, depending upon the space available at the top of the car and the opinion of the shipper as to how much top ice is required.

As the ice in the channels between the rows melts en route, the top ice drops down to refill them. However, excessive meltage leaves the channels between the upper layers of containers dry, which tends to permit them to get out of row alignment and subjects them to the hazard of breakage from transit impacts.

A study of these conditions, made under contract with the Western Growers Association, disclosed that, contrary to popular belief, the meltage of ice was substantially greater at the ends of cars, next to the bunker bulkheads, than it was in the middle of the car. Most of the test cars of broccoli and celery arrived at destination with the ice melted from the tops of containers at one or both ends of the car and with channels partly empty in those positions. Top re-icing in transit was found to be of little value under such conditions. Furthermore, breakage of containers tended to be greater at the end where the most meltage had taken place.

On the other hand, excessive depths of top ice at and near the middle of the cars upon arrival at destination was found to be a cause of breakage in unloading.

The report on the project recommends that when a car is body iced at the point of shipment, top ice at the middle of the car be not more than 12 inches deep, but that it be banked up at the ends of the car to a depth of as much as 24 inches, or as much as the space between the top of the load and the ceiling of the car permits. Attention was also directed to the need for more care in re-icing in transit to see that the ice gets to the car ends where it is needed. (*Container Breakage in Top-Iced Shipments of Vegetables*, May 1953.)

Shipping Costs of Cauliflower

In the fiscal year 1952, packing and laboratory tests were conducted by research personnel of the Western Growers Association to study the practicability of closer trimming of cauliflower heads before packing in containers in order to reduce transportation, refrigeration, and container costs in the shipping of this commodity.

Those tests indicated that more of the wrapper leaves which protect the curd of the cauliflower head while in transit could be cut away, substantially reducing the total weight of the head to be shipped and still leave enough wrapper leaves to give the curd what was felt to be sufficient protection from transit injury. It was believed that the closely trimmed heads could be shipped in double layers in the standard broccoli crate, which is somewhat larger than the cauliflower crate. The latter accommodates only a single layer. However, it remained to be seen whether these assumptions would be borne out in actual transportation tests.

Consequently, during 1953, a series of test shipments of cauliflower was made from California to eastern markets in which the arrival condition of the closely trimmed double-layer pack was compared with single-layer pack containers in the same car. At the close of the fiscal year, these data were being analyzed and a report was being prepared.

All-Purpose Containers for Tomatoes

Another phase of the work in cooperation with the Western Growers Association was a series of tests on an all-purpose container for shipments of tomatoes from California to eastern destinations. The new container, which had been developed by the Wooden Box Institute, is somewhat larger than the standard lug commonly used for place-packed and wrapped tomatoes shipped from California, and was designed to accommodate about 50 pounds of tomatoes, either place-packed or bulk-packed. The dimensions of the container also permitted its reuse by tomato repackers in the delivery of repacked tomatoes in tubes to retail outlets. Ten test shipments of the new container were made. It was originally planned that additional tests would be made from Florida and Texas during the spring tomato deals in those sections but conditions, including the poor crop and poor quality of the tomatoes, made further tests inadvisable. Consequently, it is proposed to prepare a report on the results obtained from the California tests for release early in the 1954 fiscal year.

Causes of Down Beef in Railroad Refrigerator Cars

A study of the basic causes of loss and damage in rail shipments of dressed beef, mentioned in the last annual report, was completed and a report published. It was found that inadequate maintenance of cars, rather than any deficiencies in the types of equipment or shock-absorbing accessories used in the construction of refrigerator cars in which the hanging beef is transported, was chiefly responsible for the tearing of beef quarters from the meathooks. Higher grades of beef were found to be more susceptible to injury than the poorer grades, and best results were found when forequarters were hooked under the fourth or fifth ribs. (*Loss and Damage in Rail Transportation of Dressed Beef*, December 1952.)

Transit Damage in Watermelon Shipments

Watermelons rank high among agricultural commodities in the number of dollars per car paid for loss and damage (\$37.10 per car in 1951). The Congo melon, introduced in the southeastern States several years ago, has grown in popularity because

Congo, a long melon, loaded in the conventional way, with the individual melons placed in rows end-to-end, lengthwise of the car, is particularly susceptible to damage because of bruising at the blossom end.

Upon recommendation of the Transportation Advisory Committee, a project was jointly undertaken by this Branch and the Bureau of Plant Industry, Soils, and Agricultural Engineering, in cooperation with the State Agricultural Experiment Stations and the railroads, to determine whether there might not be some other practical method of placing the melons in the car in such a way that the blossom ends, where the larger part of the bruising has been found, would not be exposed to injury from the stem ends of adjacent melons. Several alternative methods of loading were proposed for study, including placing the melons crosswise of the car instead of lengthwise, a *jumble* load in which the melons would be placed at random without any particular loading pattern, and retaining the conventional lengthwise load but placing the melons blossom end to blossom end and stem end to stem end instead of stem end to blossom end as they are now loaded.

A program of test shipments to determine the practicability and effectiveness of these methods in reducing damage was begun with the shipment of the first Congo melons from Florida in early June. Because the results of early tests indicated that the crosswise load showed the most promise of meeting the problem, further tests in fiscal year 1954 will be concentrated on the comparison of outturn results of that load with the conventional lengthwise load now commonly used.

In the first eight pairs of test cars, each pair shipped from the same point of origin to the same terminal market--one car in each pair with the melons loaded lengthwise and the other with the melons loaded crosswise--the conventional lengthwise load averaged about five times as many cracked melons and more than seven times as many bruised melons per car as the crosswise loads.

Other phases of the study reserved for next summer will include the loading time required per car and the study of the possibility of reducing labor costs in unloading melons at destination.

New Containers for Plums

As part of the program of research of the Fruit and Vegetable Branch looking toward the development of new and less expensive containers for fresh fruits and vegetables, the Branch is cooperating in the conduct of a series of transportation tests of two newly designed fiberboard containers for California plums. Four test shipments had been made at the close of the fiscal year and more are to follow.

Palletized and Unitized Loads

From time to time a number of advisory committees have recommended the study of large palletized shipping containers for agricultural products or unitizing presently existing containers in pallet lots to reduce loading, unloading, and handling costs at destination. A preliminary study of the possibilities of a large palletized container for bagged oranges was made, but this type of container did

not appear to be practicable for the purpose. It carried the oranges well but the original cost of the container and the costs of shipment and return for reuse were so large as to overcome the potential savings in loading and unloading costs. Additional studies into the possibility of unitizing present containers were planned when the development of the fiberboard carton and the apparent popularity of new, small size containers came about. Consequently, further studies of this kind are being deferred until some of the uncertainties as to the kinds and dimensions of containers that will be used in the future are settled.

Effects of Heavier Loading on Perishable Shipments

The subject of the effect of heavier loading of railroad cars of perishable agricultural commodities has been one of periodic concern to the agricultural industry; periodic in the sense that when an emergency arises, threatening a shortage of refrigerator cars, there is great concern that substantial losses may result from government regulations requiring the heavier loading of railroad cars. When the emergency subsides, the concern disappears. The problem is of such breadth that answers cannot be determined quickly. It is our present purpose, as the workload of the Transportation Staff of the Branch permits, to acquire as much information as may be developed on this question without making it a separate and definite project. When all the information available has been brought together, a report will be published. Some progress was made during the past year in acquiring information of this type and it will be continued as circumstances permit in 1954. It is hoped that the work may be sufficiently advanced for a report during that year.

WORK ON WHOLESALING, RETAILING, AND PACKAGING

Sales from 377,000 grocery and combination food stores reached a new high of approximately \$33 billion in 1952. The trend during the past two decades has been toward a decreasing number of stores selling an increasing number and volume of items per store and per employee. Supermarkets and superettes, comprising less than one-fourth of the total number of food stores, did 78 percent of total sales in 1952. The performance of the retailing function continues to require the largest gross margin of any of the marketing functions. The wholesaling and retailing functions combined require approximately one-half of the total cost of marketing farm products.

Research conducted by the Branch on retailing, wholesaling, merchandising and packaging food products is organized under three general areas: (1) Reducing the cost of handling products in retail food stores; (2) improvement of merchandising methods and practices in wholesaling and retailing; and (3) prepackaging meat, poultry and other animal products. Research in these areas is conducted primarily on a functional basis with only secondary consideration given individual commodities. The over-all efficient performance of a function often requires compromising on the handling costs of individual items.

Since most of the research conducted by the Branch is done in wholesale warehouses and retail stores, it is conducted in close cooperation with many individual retail and wholesale firms, as well as with four national trade associations. All of the research of the Branch in this field has been recommended, developed and approved by wholesale and retail industry research advisory committees.

REDUCING THE COST OF HANDLING PRODUCTS IN RETAIL FOOD STORES

Motion and time study techniques are used to improve methods, equipment, materials and layout to reduce costs of handling in the retail food stores. Surveys are made of the food industry to determine those firms that appear to be performing the best handling jobs. Then detailed time studies are made of typical operating procedures in retail food stores with different volumes, equipment, methods and location conditions. After the standard methods of performing the operation are studied, improvements are developed and tested.

Grocery Handling

In 1952, the report entitled *Some Improved Methods of Handling Groceries in Self-Service Retail Food Stores* was issued. The findings of this study were reported in the 1951-52 annual report. The results of the study have received considerable industry notice. Most of the retail trade periodicals printed summaries or excerpts from the publication. The Super Market Institute used the report as source material for the first three *Store Managers' Helper* series which they began to issue in November 1952.

Meat-Handling Operation

The objective of the research on meat handling was to increase labor productivity and reduce labor costs in retail meat markets. Research on the prepackaging of meat was conducted simultaneously with the research on the entire meat operation in both self-service and service type markets. The research has been conducted in cooperation with two large supermarket organizations within outlets located in the southeastern section of the United States. This work should be completed during 1954 and a number of publications issued. The published results should aid retail stores in improving the efficiency of their meat department operation, including improved store layouts, selection of proper equipment, and the use of those methods which will increase labor productivity and reduce operating costs. The first publication on this work entitled *Receiving, Blocking and Cutting Meats in Retail Food Stores*, was issued in June 1953.

The application of selected improvements in methods, materials and equipment to the cutting operation in the meat market of one retail store, and to the receiving, blocking, and cutting operations in three other stores increased the productivity for these three combined operations by 26.6, 36.3, 36.3 and 38.9 percent in the respective stores. These improvements represented a reduction in labor requirements in these four average sized markets of 8.5, 14.1, 16.0 and 28.4 man-hours per week, respectively.

As conventionally performed, the receiving and blocking (dividing into whole-sale-size cuts) accounted for approximately 3 percent of the total meat department man-hours and the cutting (dividing into retail-size cuts) accounted for 15 to 30 percent. Motion and time study techniques were used to measure productivity of these functions as they were being performed before the study was made, and an attempt was then made to increase productivity in each operation through the development of improved handling methods, equipment and layout.

In the receiving operation the use of the overhead meat rail increased productivity in the receiving of sides of beef from 7.87 to 13.26 sides per man-hour, or 68.5 percent more production than in receiving without a rail. Improved methods of receiving with the meat rail, and the use of a meathook stabilizer resulted in the meat rail being 82.1 percent more productive than receiving without a rail. In addition, the meat rail eliminated much of the dangerous lifting in the handling of beef quarters and veal sides. The labor requirements for receiving non-rail stock items were reduced by increasing the size of the order received, where practical, and by placing the items at the point where they were to be processed in the market.

The most productive blocking operation was achieved by utilizing the overhead meat rail and by hanging the forequarter in the chuck rather than in the rib to minimize lifting and to facilitate trimming the quarter. The use of the spinal cord remover and the calibrated knife and improved blocking methods reduced the time to block a hindquarter from 8.5 man-minutes to 6.3 man-minutes and a forequarter from 10.8 man-minutes to 8.0 man-minutes.

In the cutting operation the best productivity was obtained with a new type of cutting table with a revised workplace arrangement, using the power saw with a smear

remover attachment to remove bone and fat smear from the meat. The use of the power saw in place of the hand saw, knife, and cleaver reduced the cutting time per package from 0.295 man-minute to 0.182 man-minute, and provided an average increase in production of 62.1 percent for five representative items in one market. The use of the smear remover increased production over conventional power saw methods, for those cuts requiring cleaning, by 21.5 percent in one market and 32.5 percent in another. The use of a hand saw with a blade that was part knife and part saw increased production for cutting hams by 44.4 percent over the use of the hand saw and the knife.

The improved workplace arrangement reduced walking time and placed all tools and materials within easy reach of the operator. The bone and fat barrels, trimming cans, empty pans, wrapping paper, strings, knives and other tools also were prepositioned within easy reach. This workplace arrangement reduced space requirements 25 percent and increased production 10 percent.

Produce-Handling Operation

The objective of this phase of the research is to develop improved methods of handling produce and frozen food in service and self-service type retail food stores. The research is being conducted in cooperation with four supermarket organizations in the eastern part of the United States. Some of the basic data have been collected.

Basic data have been collected from test stores in the cooperating supermarket organizations to determine the present allocation of man-hours by type of produce for each of the major functions of: (a) Receiving and storage; (b) preparation for display; (c) prepackaging, weighing and pricing; (d) display, maintenance of display racks; (e) retrimming and rehandling of prepackaged and bulk displayed merchandise; (f) customer service, to include weighing and pricing of merchandise selected by the customer from bulk displays; and (g) cleanup and setup, including pulling wet rack at night, storage and redisplay of this merchandise in the morning. Related by type of produce and store to these functions were such major factors as man-hours for handling and amount of spoilage. Flow charts for each of the ten major produce commodities were developed.

A comparative analysis of present handling methods and equipment has been largely completed. By means of detailed time studies of each of the major functions in each market, man-hour requirements and direct labor and materials costs for each of the major produce commodities were determined. The productivity of various methods used in repetitive operations in the test stores was compared with other stores employing different methods. Various types of service and prepackaging scales were tested for comparative accuracy and speed.

During the next fiscal year, it is planned to: (1) Develop through the use of motion and time study and work simplification techniques improved work methods; (2) develop in cooperation with manufacturers improved service and prepackaging scales; (3) develop and test improved workplace arrangements for prepackaging; (4) develop and test improved equipment for transporting produce from preparation area to display area; (5) design and test improved produce department backroom layout which will reduce the number of handlings, eliminate product backtracking and improve product flow; and (6) expand the acceptable improvements in methods, equipment, materials and layout to additional produce markets.

Check-out Operation

In 1951 the Branch issued a report on a check-out counter which was 38 percent more productive than conventional equipment. Since then some improvements on this equipment have been made by industry. These improvements have been incorporated into new counters and are being tested in several stores.

PREPACKAGING MEAT, POULTRY, AND OTHER ANIMAL PRODUCTS

As of January 1, 1952, there were about 248,500 retail grocery stores in the United States selling meat. Thousands of these stores had either complete or partial self-service meat departments. During 1952 the number of stores selling meat by self-service increased about one-third. With the rapid adoption of this new method of merchandising meats, many new problems are confronting store operators. Many operators are using makeshift methods, procedures, and equipment to prepare their meats for sale through the self-service case.

The objective of current research is to assist retailers in developing and adopting efficient methods of prepackaging meat in self-service food stores. The work on this project was closely coordinated during the past year with the work on reducing handling costs in retail meat markets. A portion of the work has been completed and a report, *Packaging and Displaying Meats in Self-Service Meat Markets* was issued in June 1953.

Packaging and displaying of self-service meats in two typical retail food stores accounted for over half of the total meat market man-hours. Motion and time study techniques were used to measure productivity of the functions as they were typically performed in these meat markets. An attempt was then made to increase productivity in each operation through the development of improved handling methods, equipment and layout. The application of selected improvements in methods, materials and equipment to the packaging and displaying of self-service meats in these two stores increased productivity in these operations 10 and 23 percent. This amounted to a savings of 10.6 and 31.2 man-hours per week, respectively. In addition, materials costs were reduced \$19.08 and \$10.20 per week in the two stores studied.

Wrapping methods which proved to be most advantageous included the following: (1) When a board or tray is required it should be applied to each package as the package is wrapped; (2) wrapping film should be purchased in roll form and presheeted to the proper sizes in the market; (3) sheeted cellophane should be stored in trays which turn up the front edge of the film pack or in racks which provide a vertical support over which the film is positioned. Sheeted pliofilm should be stored in open front trays provided with spring loaded clips for holding the film in place; (4) the diagonal wrap should be used instead of the square wrap, as the latter method requires from 15 to 62 percent more film; (5) when proper sizes of cellophane are used the hand iron should be used rather than the seal plate; and (6) the hand iron should be held in the hand while the various folds are being made in wrapping a package. Laying the iron down between seals required 10 percent more time.

A set of principles for use in setting up a wrapping station was developed and from these principles a wrapping table was designed which prepositioned all tools,

materials and working surfaces within easy reach of the operator. By using the new table the work was less fatiguing and a little faster than when the former ones were used.

It cost less to package meats in sheet cellophane than in sheeted pliofilm or roll pliofilm at film prices prevailing when the study was made. The pounds of meat wrapped per pound of film used were considerably higher for pliofilm than for cellophane due to the larger number of square inches per pound for pliofilm. On the other hand, labor productivity was greater and the film cost per package was lower with sheet cellophane than with sheeted pliofilm.

Studies of rewraps showed that more torn and leaky packages were found with cellophane and more discolored packages with pliofilm, but the greatest cause of rewraps was the inaccuracy in anticipating consumer demands. In addition to the extra cost of the film, more rewraps were found with 450-gauge cellophane than with 300-gauge cellophane.

The installation of proper sizes of boards, trays and cellophane in two markets resulted in a saving of 8 percent in board and tray costs and a 19.4 percent saving in film. Boards and trays were selected that did not overlap the meat and film sizes were selected so that the film had a one-inch overlap on an average size package. Time studies indicated a slight increase in packaging production per man-hour when these new materials were used.

A new type of pricing table was developed which resulted in improved handling methods, **increased productivity and reduced fatigue**. This table prepositioned all tools and materials within easy reach of the operator. The most productive method for pricing even weight packages received in the store already packaged was to use a self-inking stamp set furnished with a quick-drying ink.

The costs of processing previously wrapped items was about one-fourth of that for meats prepared and packaged in the store. The selling prices, direct costs and margins in one firm for handling three luncheon meat items, purchased both bulk and packaged, indicate that by purchasing some items prewrapped and other items in bulk form returns could be increased.

Superior scale readability, good selection of prices per pound and fast balancing of one of the four prepackaging scales tested gave this scale a considerable advantage in productivity and accuracy. Based on a survey of the most common prices found in meat markets it was ascertained that the price plates of the four types of scales tested ranged from 75 to 99 percent of the number of price observations in the survey. A device for simplifying the setting of the tare on prepackage scales proved more convenient and increased production.

Two label machines tested proved profitable when 2,000 or more packages per week were handled. The separate label printing machine combined with a conventional scale provided a saving in label cost, and in addition reduced labor cost more than the combination scale and label printer. Both machines increased operator productivity over the conventional operation and provided more legible labels which reduced the error of reading the prices at the check-out counter.

A considerable amount of time can be saved in displaying meat by increasing the number of units handled per trip to the display cases. In one of the test stores where full pan loads were not carried, time required for performing the display operation was decreased 25 percent by handling full loads instead of following their conventional display practice.

During the next fiscal year it is planned to test out and adopt the results obtained in stores located in the southeastern section of the United States in other stores located throughout the country. To accomplish this it is planned to remodel or have new stores built according to our specifications. Handling costs and sales in these test markets will be compared to the conventional layouts and methods obtained by the firm in their other stores.

IMPROVEMENT OF MERCHANDISING METHODS AND PRACTICES IN WHOLESALING AND RETAILING

Work undertaken in fiscal year 1952 on three lines of research continued during fiscal year 1953. Designed to improve food merchandising methods and practices, the three lines are: (1) Cooperation between wholesalers and retailers to increase efficiency and lower costs for both groups, (2) efficient utilization of store selling space and equipment, and (3) development of more efficient and effective personnel training and supervisory practices.

Wholesale-Retail Cooperation in Food Distribution

Many wholesale grocers serving independent retail grocers have launched or are seriously considering launching broad programs to assist their retail customers in becoming more efficient and effective operators. A survey was conducted to obtain the retailer point of view on such programs. Completed questionnaires were obtained from about 1,700, or 55 percent, of the retail customers of eight wholesalers. The wholesalers were selected to represent different types of operation and different viewpoints on wholesaler assistance to retail customers. The survey was a sequel to earlier studies among the wholesale grocers who serve these retailers. The earlier studies were reported on in the 1952 annual report and were published under the titles: (1) *How Some Wholesale Grocers Build Better Retailers*, and (2) *Methods of Handling and Delivering Orders Used by Some Leading Wholesale Grocers*.

The survey was designed to furnish information on: (1) Which aids made available by the wholesalers were actually being used by their retailers; (2) what suggestions the retailers had for making the wholesalers' aids more useful; and (3) how acceptable to the retailers were certain trade proposals for reducing wholesaler operating costs. The study has been completed and a report, *Views of Independent Grocers on Wholesaler-Retailer Relations*, was issued in June 1953.

A basic finding of the survey was the need for wholesalers to tailor their programs to the requirements of different kinds of retail operations. Analysis disclosed three types of grocers: (1) The store of small and static volume (in these stores owners were usually not interested in business improvement or wholesaler aid); (2) the middle-size store (volume of \$1,000 to \$6,000 per week) in which sales volume was rising and in which the operator was eager for wholesaler assistance to

further increase his business; (3) the large store, where business ambition and desire for assistance was high but where there was less dependence on the wholesaler for assistance.

Among the aids wholesalers customarily offer retailers, widest interest and utilization was found for information which helped retailers price their merchandise effectively, followed by assistance on store promotions. Aid on store engineering, record-keeping and training of retail store personnel was wanted and utilized by fewer retailers. However, among larger stores, greatest interest was evidenced on training store personnel. Analysis showed that retailers tended to accept the kind of assistance program their supplier offered; however, where wholesalers offered extensive assistance the grocers reciprocated with purchasing loyalty.

Retailers reporting in the survey had specific suggestions on how wholesaler assistance could be made more helpful. In advertising and promotions, they urged more retailer participation in planning, and the featuring of well-known items at attractive prices. In store operations, retailers wanted ideas that had proved effective in increasing customer appeal and lowering operating costs. In personnel training they suggested clinics on store management generally as well as on specific departments such as meats and produce.

The survey also disclosed that many retailers were willing to accept proposals which would reduce costs of delivery from wholesaler to retailer. For example, where not currently practiced, 50 percent of the retailers said they would accept a proposal for minimum size orders and for once-a-week delivery; 30 percent would agree to help drivers unload merchandise; 33 percent were willing to pay drivers for groceries received and thus reduce the need for salesman calls; 29 percent would accept groceries without checking at time of delivery to reduce the driver waiting time.

In cooperation with the National-American Wholesale Grocers Association a new phase of research has been started. This is concerned with methods of increasing efficiency and productivity of personnel employed as warehousemen and drivers by wholesale grocers. The objectives of the research are to: (1) Establish standards for warehouse employee productivity in order selecting, checking, loading and for delivery truck drivers. These standards will provide for such differences as warehouse design, order size, order composition, type of delivery route, distance and number of delivery stops. (2) Evaluate and develop methods and policies for use by wholesale grocers for increasing employee efficiency and productivity. (3) Measure the effect of the use of standards, improved policies and methods on wholesaler warehousing and delivery costs.

Efficient Utilization of Store Selling Space and Equipment

The general objective of this research is to improve the efficiency of departmental display space in retail food stores. During fiscal year 1953 a specific segment of this general line of research was completed. In November 1952 a report entitled, *Better Utilization of Selling Space in Food Stores - Part I. Relation of Size of Shelf Display to Sales of Canned Fruits and Vegetables*, was issued. The results of this study were reported in the 1952 annual report. The response of the

industry to this report has been unusually favorable. It has received widespread reproduction in the industry periodicals and many firms have been applying the principle developed in the study.

Preparatory to expanding the work a pilot study was made in which the conclusions drawn from the previous study on space utilization were applied to the shelf display of 286 items in a large supermarket. These items were stocked on the basis of their turnover and the shelf space allocated to them decreased from 195 linear shelf feet to 125 linear shelf feet with no change made in the lines carried. There was practically no difference in the total quantity sold between the period when 195 shelf feet were used and the period when 125 shelf feet were used.

The National Association of Retail Grocers is actively cooperating with the Department in applying the conclusions drawn from this research to the industry. Currently, a number of stores have been selected by them in which the principles developed by the study will be applied in stocking the grocery shelves of the stores. The stocking procedure is expected to decrease stocking costs, make space available for additional items, and minimize the *off the shelf* problem. The results of the new stocking plan will be measured.

Development of Improved Training and Supervisory Practices

The objective of this line of research is to help obtain the full potential value of sound operating procedures and improved equipment by better personnel management practices, thus holding down the cost of retailing food. An initial study in this new line of research begun during fiscal year 1952 has been completed and a second study is under way.

In June 1953, a report on the initial study was issued entitled *Improving the Performance of Retail Food Store Cashiers Through Better Training Methods*. The study was conducted in cooperation with two supermarket organizations located in eastern metropolitan areas. In the controlled experiment among food store cashiers, conventional instruction by written memorandum was contrasted with a method in which employee participation was emphasized. The training method which gave cashiers an opportunity to discuss their work and to participate in a training conference proved considerably more effective in improving employee performance. Among the results obtained were: (1) Greater acceptance of new check-out procedures (a 28 percent improvement over performance obtained by the customary training method tested); (2) closer adherence to established check-out procedures (6 percent improvement); (3) more courtesy to customers (27 percent improvement); (4) better utilization of time when not serving customers at the check stand (of ratings given cashiers instructed primarily by written memorandum, 30 percent were excellent and 35 percent were poor; of ratings given cashiers participating in their instruction, 43 percent were excellent and 14 percent were poor); and (5) more employee satisfaction with the instruction received. The performance of cashiers who received the improved training was better not only during a 4-week period after the training date, but also 10 weeks later when additional observations were made. While the study was limited to improving performance of cashiers, it suggests that the same methods of instruction could be employed with comparable results for other groups of food store employees.

The second project in this line of research, now begun, has as its objectives the determination and evaluation of more effective methods of introducing labor-saving equipment and practices among food store employees in order to obtain the fullest potential value from such improved procedures. Experience has shown that often new equipment is not properly used and new procedures are not consistently followed, or followed for a short time and then abandoned. Thus the productivity expected from improved methods and equipment is not obtained by the industry. There is general agreement that the returns from new procedures and equipment are affected in large part by the way they are introduced to employees.

STUDIES TO IMPROVE MARKET NEWS

Timely and unbiased marketing information is essential to efficient marketing and for the market news service to do a good job in providing this information, the many different phases of its program must be periodically studied, the accuracy of its releases checked, any shortcomings discovered, and improvements made. The market news service covers nearly all commercially important farm commodities, and is carried on from 107 full time offices and 41 seasonal offices. Outside the Census Bureau, the market news service is one of the largest statistical gathering agencies of the Federal Government. Yet because of the way the market news service has developed over the years--growing office by office--very little use has been made of modern statistical and survey methods. In studies made to improve this service, special attention is given to developing the use of statistical methods of gathering data both to improve accuracy and decrease cost.

The studies which this Branch undertakes to improve market news are those which are recommended by the Office of the Assistant Administrator for Marketing or heads of the various market news services. They usually arise from criticisms or suggestions for improvement from persons using the reports or from recommendations of the Agricultural Marketing Act Advisory Committees. The work is usually carried on in cooperation with the Federal-State market news agencies involved and sometimes independently as required.

APPRAISAL OF MARKET NEWS SERVICE FOR BROILERS

Appraisals were completed during the year as to how broiler market news reporting in the Shenandoah Valley of Virginia and in North Carolina might be improved and final reports were submitted for administrative use. Field work and preliminary analysis were completed on an appraisal of broiler market news in West Virginia. Many of the recommendations coming out of these studies to increase the effectiveness of market news as an aid in marketing have already been put into effect.

Shenandoah Valley Area of Virginia

For market news to be of value, it must be used in the making of marketing decisions. To appraise how well it was performing this function in the marketing of broilers, it was necessary to first determine the channels through which broilers were moving, what marketing decisions were being made at each step in marketing, and how market news was being used in each of the different kinds of decisions being made by farmers, buyers, processors, feed dealers and others financing broiler production. The channels of flow for broilers in the Shenandoah Valley Area of Virginia were determined to be as shown in figure 20.

An analysis of the uses made of market news at each step in the marketing channel indicated several important modifications were needed in the market news program. It was found, for example, that reporting prices as of the day sales were negotiated with producers would be more valuable than the method being used of reporting prices as of the days birds were picked up and payment made. There is usually 1 to 4 day's time lag between when sales are negotiated and the time birds are picked up. Such prices would be much more useful to growers and feed dealers in

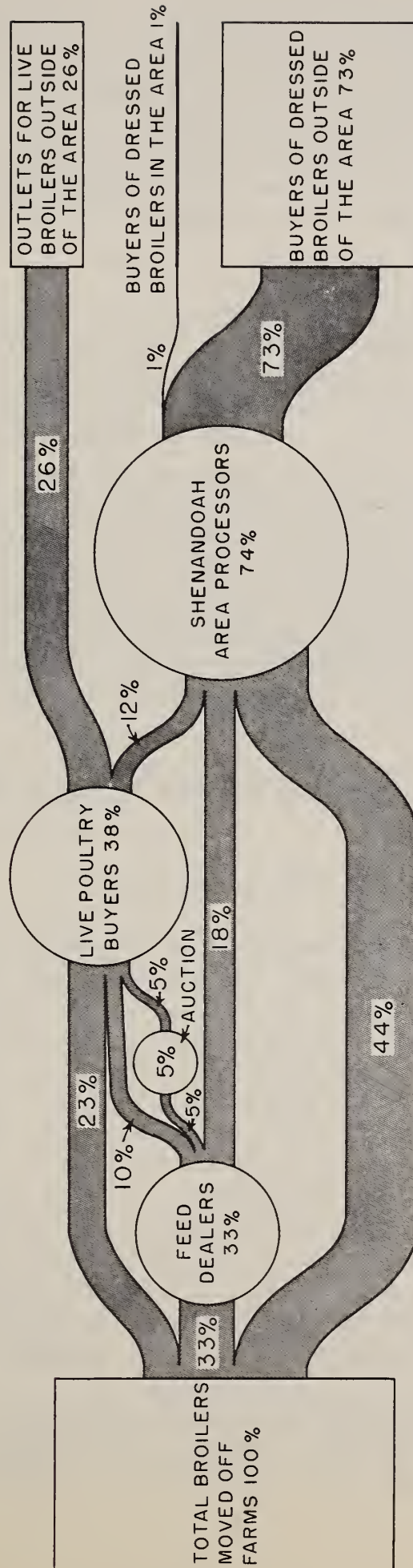


Figure 20.--Channels through which broilers produced in the Shenandoah Area of Virginia are marketed.

bargaining--not only because they are more timely, but also because they would reflect only one day's transactions rather than sales negotiated over several days. From the viewpoint of processors and live buyers, the reporting of more current prices would aid their buying relationship with growers. As another way of speeding up the releases of the daily report, it was found to be practical to use an earlier cutoff time when gathering data. This made it possible for market news to get releases to the local radio station in time for it to carry the current day's report on the noon broadcast, rather than the previous day's report the station had been carrying. It also was found that information on supply, demand, and other market factors was being carried in the reports in too highly a condensed form, and that the industry, particularly the farmers, needed more detail.

A comparison of buyer and processing plant records on what was paid farmers with the daily market news releases showed that about 76 percent of sales were covered by the market news price range, 16 percent of the sales, however, were at higher prices, and 8 percent at lower prices. These records also showed that price differentials large enough to be of market news interest to farmers were commonly being paid for lots of different weight birds. It was found that there were not so many individual flocks of birds being bought from farmers each day but that it was feasible for a reporter to get complete information on each lot as to price, weight, quality, and any unusual conditions regarding the sale. The gathering of this specific information on each lot was recommended to replace the practice of obtaining only a general or summary statement from buyers. This helped prevent misinterpretation of information buyers gave. It also provided the reporter with material needed to report accurately differences in prices due to weight, the total price range, and at what price most sales were made.

All of these recommendations have been either put into effect, or are in the process of adoption.

Broiler Producing Sections of West Virginia

Commercial broiler production is an important industry in certain sections of West Virginia, and the nearest available market news information at the time of this study was that reported in the Shenandoah Valley of Virginia. This information and certain other data supplied over the market news leased wire system is distributed to broiler producers by the West Virginia Department of Agriculture. An appraisal was made to determine if the information reaching West Virginia broiler producers was adequately meeting their needs. It was found that producers in the Wardensville section of West Virginia, which lies across the State border from the Shenandoah Valley of Virginia, rely on approximately the same market outlets as those used by Virginia producers. The birds are processed by nearby plants, and largely shipped to terminal markets on the Atlantic Seaboard. Prices in the Wardensville section were found to be comparable to those in the Shenandoah Valley. To make the Virginia report of more value, however, the study recommended that poultry buyers in the Wardensville section be included in the Virginia market news report. This is now being done.

It was found that the majority of birds grown in the South Branch section of West Virginia are shipped live to markets in western Pennsylvania and Ohio, and that in this section buying and selling is largely done on Saturday and through a system

of auctions. Prices received for birds were usually higher than in the Shenandoah Valley and the Virginia report was only of limited use to these producers. The study recommended that: (1) To serve the needs of producers in this section a weekly report of the local auction buying and selling on Saturday was needed; (2) market news information from Pittsburgh¹ should be made available; and (3) because of heavy competition they were meeting in the Ohio and Pennsylvania markets from broilers produced in Indiana, they needed to receive the available broiler market news information from that State. To date, the first two of these recommendations have been put into effect.

Broiler Producing Sections of North Carolina

The pattern of marketing broilers in North Carolina was found to be somewhat different from that in the Shenandoah Valley Area of Virginia, and their market news needs differed. The proportions of birds moving through the different channels to market are shown in figure 21.

It was found that the farmers relied heavily on the feed dealers for information and for assistance in selling their birds, and that the prices reported by market news in North Carolina were widely used as a basis for selling. Heavy emphasis was placed by all members of the industry on obtaining market news information from competing broiler producing areas in North Georgia, Del-Mar-Va, and Shenandoah Valley--particularly in North Georgia. As to local information, variations in available supplies of birds was considered to be the information most needed. The feed dealers at present place a good deal of reliance on their own knowledge of supply conditions, and nearly all said that in order to get more complete information they would be willing to supply the market reporter with weekly data on number of birds ready to be marketed. The market news service at this time has not been able to undertake this extra task.

There are three producing sections in North Carolina for which prices are reported--Central North Carolina, North Wilkesboro, and Asheville. At the time of this study only the Central North Carolina prices were carried on the market news leased wire system. Prices for all sections are now carried. To increase the representativeness of prices reported it was recommended that the number of buyers and processors contacted in both the Central North Carolina and North Wilkesboro sections be increased. This has been done.

MARKET NEWS REPORTING OF POULTRY AND EGG MOVEMENT

In cooperation with the Poultry Branch a study was undertaken to improve market news reporting of the volume of poultry and eggs moving through assembling and processing plants. As this is the first point in the marketing channel where changes in the volume of movement of poultry and eggs can be reported, the data are of special value as marketing information. Market news has for many years been reporting receipts of poultry and eggs at Midwestern plants and egg receipts at plants in the Pacific Coast States and certain Eastern States, but marketing of poultry and eggs has so changed in recent years, that a complete appraisal of the adequacy of this data was needed.

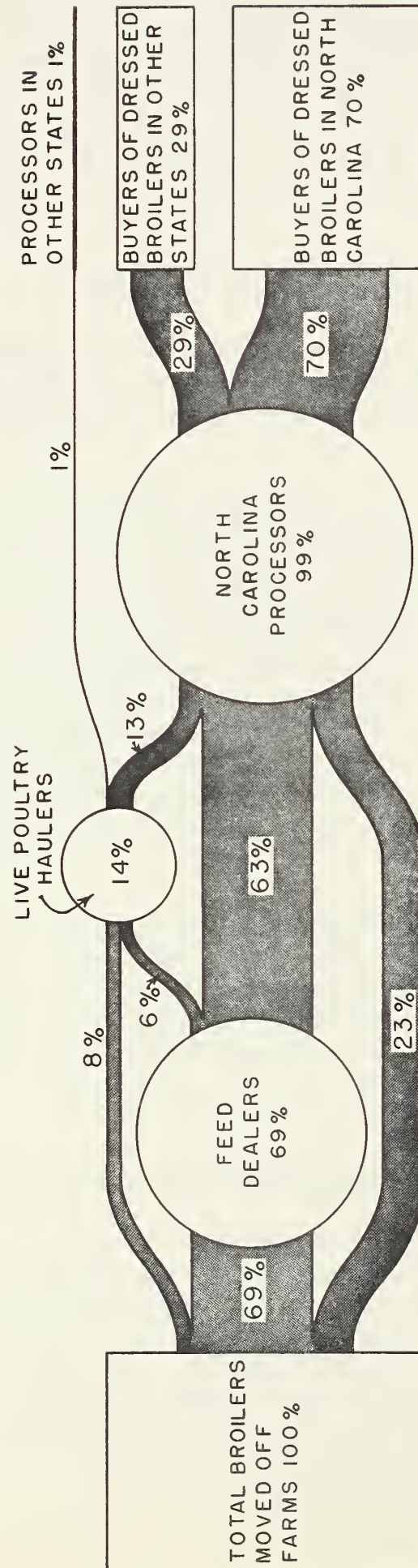


Figure 21. --Channels through which broilers produced in North Carolina are marketed.

Starting in July 1952, and continuing through the year, records on receipts of eggs, hens, cocks, broilers, and turkeys from 200 plants in the 17 Midwestern States were gathered weekly and reported on a research basis. During this time the data were studied to develop improved methods of gathering them, and to develop an efficient sample design. It was brought out that large errors in the reporting of receipts of poultry and eggs were being caused by certain plants receiving some of their supplies from other plants. To avoid duplication in reporting, the number of birds slaughtered could be reported rather than receipts, and for eggs those received from other plants and those received from farmers, hucksters, and receiving stations would need to be reported separately. Another source of large errors was found to be in the difficulty when gathering data by mail, to keep informed on when seasonal plants began and stopped their operation. These and a number of smaller errors, it was determined, could best be corrected by gathering the needed data through personal contacts of inspectors and graders stationed at many of the plants. The local grader or inspector through his personal knowledge of the operations of the plant in which he is stationed is in a position to verify the accuracy of the reports before they are sent in to a central office for tabulation. A classification of plants was worked out so as to make the fullest use of data from plants using the Inspection and Grading Service, and which at the same time would require only a minimum of gathering of data by mail contacts.

FEED MARKET NEWS

Work begun last year to develop and test methods of reporting feed market news was continued during this year. The field work under this study which included a trial reporting of feed market news was carried on under contract with the University of Arkansas. It was concluded as a result of this work that market news reporting of feeds was practical and useful. At the beginning of the trial reporting it was found that large differences of as much as \$1.00 and more per bag existed in the selling price of feeds of comparable quality. As the trial reporting progressed, reduction in these differences occurred. During this time farmers reported that they were using the information to do a better job of buying. Feed costs represent approximately 60 percent of the cost of producing broilers and approximately 30 percent of producing milk. For this reason savings in feed costs have a substantial influence on the farmers' income. Also prices for feed must be considered as well as prices for poultry and milk when production decisions are made.

A special section of the report was developed to help keep producers better informed on changes in feed costs and broiler prices. This section of the report as it appeared on a typical week was as follows:

RETURNS FOR BROILERS ABOVE FEED AND CHICK COSTS

At today's average broiler price of 28.00 cents per pound, the returns on 1,000 birds, less average feed and chick costs, were \$195.80 for the Northwest Arkansas area and \$161.97 for the Arkansas Valley area. Out of this the producer must pay for utilities, labor, and other costs.

Returns for 1,000 2-3/4 lb. broilers \$770.00

	<u>N.W. Ark.</u>	<u>Ark. Valley</u>
Average feed cost per 1,000 broilers <u>1/</u>	\$409.20	\$443.03
Average chick cost per 1,000 vaccinated broilers	<u>\$165.00</u>	<u>\$165.00</u>
Total feed and chick cost	\$574.20	\$608.03
Returns above feed and chick costs	\$195.80	\$161.97
Returns above feed and chick cost, average last week	\$189.75	\$156.75
Returns above feed and chick cost, 10 weeks ago	\$114.95	\$ 73.70

1/ This is based on today's average feed cost of \$4.96 (Northwest Arkansas) and \$5.37 (Arkansas Valley) per 100 lbs. of 20 to 21 percent protein broiler ration and a conversion ratio of 3 lbs. of feed to 1 lb. of broiler.

Considerable progress was made during the year in developing methods of classifying mixed feeds for market news purposes. It was found that information on minimum percent protein and maximum percent fiber that is required by law to be affixed to each feed bag could be satisfactorily used, provided the feeds were first carefully separated according to the exact use for which they were prepared. For example, growing mash for broiler production must be distinguished from growing mash for raising pullets for laying flock replacements, and broiler starter prepared for the first five days of feeding must be distinguished from broiler starter prepared for the first 5 to 6 weeks of feeding.

Because of special requests for the information, prices on sudan grass seed for pastures was reported during the spring along with feed prices. An illustration of the price table carried in the report is given in figure 22.

This trial reporting was discontinued in June, and a report on the research findings is being prepared. The methods developed during the study are now being used by the States of Arkansas and Alabama, respectively, in carrying on feed market news reporting on a regular service basis.

REPORTING VOLUME OF RETAIL SALES

As part of an over-all study to determine the practicability of market news reporting at the retail level, an analysis was completed and a report published on methods of reporting volume of retail sales for individual commodities. This was exploratory work growing out of the expressed interest of a number of industry groups to have information on volume of sales reported as an aid in merchandising their products.

ARKANSAS WEEKLY FEED REVIEW

ARKANSAS WEEKLY FEED REVIEW

Broiler mixed feeds generally declined 2-4 cents this week. Mixed feed ingredients generally unchanged. Cottonseed meal dropped about 20 cents on average prices.

	Broiler	Broiler	Breeder	Laying	Laying	Chick	Chick	Scratch	Chops
Fishers:	Ratio	: Mash	: Starter	: Grower	: Grain	: Protein	: cracked		
Protein:	Pro.	Pro.	Pro.	Pro.	Pro.	9-11	shell		corn
Fiber:	17-18	19-20	17-18	9-11					

[illegible]

Note: These are retail cash prices at the store and do not include finance and delivery charges. Adjustments for value of bags are as follows: Paper .00, burlap .05, cotton .10, print .30, prices are per 100 # unless otherwise specified.

Figure 22.--Price table from Arkansas Feed Market News Report of May 4, 1953.

The study brought out that volume of sales of individual food items and the availability of such items in retail food stores could be reliably reported using a sample of stores. It was also found that such data could be tabulated and released on the second day after being gathered. This speed in processing such data is essential to its usefulness in making marketing decisions.

The reporting of retail sales on a regional basis, including several States, was found to be more practical than reporting by individual cities, for two reasons: (1) In using a sample of all types of stores, reliable estimates can be prepared with only a small increase over the sample size requirements needed to report for a single city, and (2) reporting on a regional basis makes possible the use of regional and national chain store warehouse records on total deliveries to their stores. This is because these warehouses usually serve more than one city, and total delivery figures are easier to make available than deliveries to any specified group of stores. The use of this data from chain store district warehouses was found to cut the sample size requirements about in half from what is required when a sample of individual chain stores is used along with the sample of independent stores. Tests showed that the data on deliveries to stores provided as satisfactory a measure of sales as when actual sales were computed or adjusted for changes in individual store inventories. This is so because storage space in most stores is small in relation to the volume sold.

The sample size requirements were found to differ widely by commodities, but in general the requirements for reporting sales by 8-week periods were only about one-third that required for reporting sales for either weekly or 4-week periods. These requirements for reporting retail sales by 8-week periods for a region including several States was determined to be as follows:

	<u>Sample size needed for all stores</u>	<u>Sample size with chain stores data given</u>
Canned fruits and vegetables	270	100
Frozen fruits and vegetables	160	70
Red meats	150	90
Dressed poultry	80	40
Eggs, butter, and oleomargarine	40	20

Information on percent of stores carrying individual items can be obtained at the same time information on volume of sales is gathered. The sample size requirements, however, were shown to be different. For some commodities the sample size required for estimating the volume of sales was smaller, and for others the sample requirements for estimating percent of stores carrying individual items was smaller. This additional data gives current information on how well the job of distributing individual foods is being done.

DEVELOPING NEW SERVICE WORK IN MARKETING

Effective governmental aid in improving the marketing of agricultural commodities requires much more than the conducting of marketing research and the dissemination to the public of the knowledge gained from such research. It also requires marketing service work in diagnosing marketing ills, prescribing proper remedies, and rendering on-the-spot assistance in the application of the remedies.

The need for marketing service work was recognized by Congress in enacting the Agricultural Marketing Act of 1946. This Act authorizes cooperative projects between the U. S. Department of Agriculture and the State departments of agriculture, under which the latter may conduct marketing service activities on a matched-fund basis. The State departments of agriculture through their regular activities such as market news, grading and inspection, and regulatory work are brought in close contact with the marketing operations and marketing agencies in their States, and are, therefore, in a favorable position to conduct market service work.

A program for developing new marketing service activities in cooperation with the States, under the above Act, has been in operation since 1948. In February 1953, direct supervision of this program was transferred to the Branch from the Office of the Assistant Administrator for Marketing.

Under this program three broad areas of marketing service work have been developed, with each participating State conducting one or more lines of work within one or more of these areas. These areas of work include: (1) Demonstrations and other activities conducted at the various steps in the marketing channel designed to improve and maintain the quality of agricultural products and to expand sales volume; (2) technical assistance to marketing agencies designed to help them in making improvements in marketing methods, facilities, and plant layouts and thereby reduce operating costs; and (3) collecting and disseminating needed market information which is not otherwise available and conducting experimental market news services. During the year 32 States and 3 Territories participated in the program and conducted 89 separate lines of work.

Twenty-four States or Territories conducted service programs to improve the quality of agricultural commodities and expand market outlets. Programs were carried on to improve methods of grading, packing, packaging, handling, loading, transporting, and distributing. Services were rendered by experienced marketing specialists of the cooperating governmental agencies to producers, handlers, shippers, processors and others in order to aid in the solution of specific problems encountered in the marketing of their products. In connection with these programs, numerous demonstrations were given at local packing sheds, at concentration points, or at other types of marketing facilities.

Twenty-seven States or Territories carried on activities in the field of collecting and disseminating State and local agricultural data covering a wide variety of information relating to marketing. These programs were restricted to securing information needed in the solution of marketing problems that were not available from agencies of the U. S. Department of Agriculture or other sources. Several States assisted in bringing about better distribution of various types of agricultural

commodities by assembling and making available to the trade special market information relating to quantity and quality of specific products available in local production areas immediately preceding dates of harvest, rate of movement during harvest from the areas, total marketing supplies from all production areas, current and prospective local and terminal market demand conditions, weather forecasts for terminal markets, and the location of potential market outlets in local and nearby markets.

In other States tree counts, by varieties and age groups, have been collected for such fruits as apples, peaches, and cherries to furnish the industry with indications of potential future production and competition. Also, in some States data have been secured for local or area production estimates of grain as a guide for the location of marketing facilities in Mid-Atlantic or Southern States where grain production had increased more rapidly than the construction of marketing facilities.

Changes in our marketing system have created a demand by farmers and dealers for expanding the present market news systems to include price quotations close to the point of sale as well as the terminal markets. Experimental market news programs to satisfy this demand have been carried on in several States for a one- or two-year period for livestock, poultry and eggs, fruits and vegetables, and other agricultural products.

In the field of furnishing technical assistance to marketing agencies designed to help them in making improvements in marketing methods, facilities, and plant layouts as a means of reducing operating costs, seven States carried on activities concerned principally with improving: (1) Terminal market facilities and equipment; and (2) local market facilities needed in assembling, warehousing, processing, packaging, and handling agricultural products. In addition, several States cooperated with the Branch in the establishment of new market facilities and in taking leadership in encouraging the construction of the needed facilities. Promotion by State departments of agriculture has led to the construction of grain elevators with efficient grain drying facilities in several of the Mid-Atlantic and Southern States. Other assistance has been given in the development of poultry dressing plants in a few States. Similarly, assistance has been given to the revamping of present facilities and equipment and the construction of new plants for many agricultural products by the States participating in this program.

These new lines of marketing service work, developed on a matched-fund basis, have added to and supplemented the regular programs of the State departments of agriculture. Annual reports from the States covering their activities during the year under each line of work are now being received. These will be analyzed and summarized. A summarization of these activities should be ready for publication in December 1953.

RECENT PUBLICATIONS OF THE MARKETING AND FACILITIES RESEARCH BRANCH

1. The wholesale market for fruits, vegetables, poultry, and eggs in Jackson, Miss.
2. The wholesale market for fruits, vegetables, poultry, and eggs in New Haven, Conn.
3. Supplement to a report entitled "The wholesale market for fruits, vegetables, poultry, and eggs in New Haven, Conn."
4. The wholesale fruit and vegetable market of Miami, Fla.
5. The wholesale fruit and vegetable markets of Tampa, Fla.
6. The wholesale markets for fruits, vegetables, poultry, and eggs in Atlanta, Ga.
7. The wholesale market for fruits, vegetables, poultry, and eggs in Hartford, Conn.
8. A plan for further development of the Connecticut regional market at Hartford
9. The wholesale market for fruits, vegetables, poultry, and eggs in Columbus, Ohio.
10. The wholesale market for fruits, vegetables, poultry, and eggs in Baton Rouge, La.
11. The wholesale market for fruits, vegetables, poultry, and eggs at Richmond, Va.
12. The Benton Harbor fruit market at Benton Harbor, Mich.
13. The wholesale market for fruits, vegetables, meat and meat products, poultry, eggs, and other produce at Houston, Tex.
14. The Columbia, S. C., produce markets
15. The wholesale markets for fruits, vegetables, poultry, and eggs at Greenville, S. C.
16. Concentration markets for fruits and vegetables in Sumter and Lake Counties, Fla.
17. The wholesale produce market at St. Louis, Mo.
18. The wholesale markets for fruits, vegetables, poultry, and eggs in Greater Little Rock, Ark.
19. The wholesale produce market at Milwaukee, Wis.
20. The wholesale market for fruits, vegetables, poultry, and eggs at Savannah, Ga.
21. The wholesale markets for fruits, vegetables, poultry, and eggs at Tulsa, Okla.
22. The wholesale produce market at Indianapolis, Ind.

23. The Raleigh, N. C., produce markets
24. The wholesale produce market at Norfolk, Va.
25. East Texas produce markets and plans for new markets at Tyler and Jacksonville, Tex.
26. The wholesale produce markets at Boston, Mass.
27. Wholesale market for fresh fruits, vegetables, poultry, and eggs in Louisville, Ky,
28. The wholesale produce market at Huntington, W. Va.
29. The Central Retail Food Market of Cleveland, Ohio
30. The wholesale produce market at Winston-Salem, N. C.
31. The wholesale produce market at Nashville, Tenn.
32. The San Antonio, Tex.; produce markets
33. The wholesale produce market at Asheville, N. C.
34. Marketing facilities for farm and related products at San Juan, Puerto Rico
(Agric. Inf. Bull. No. 60)
35. The wholesale produce market at Beckley, W. Va.
36. The wholesale produce market at Waco, Tex.
37. Some plans for new market facilities for the wholesale handling of produce in
Philadelphia, Pa.
38. The wholesale produce market at Toledo, Ohio
39. Wholesale produce market at Bridgeport, Conn.
40. Egg marketing facilities in the Winston-Salem, N. C. trade area
41. The wholesale produce market at Rochester, N. Y.
42. Grain marketing facilities in the Piedmont area of North Carolina
43. The relation between locker plants and home freezers in the distribution of frozen
foods in Arizona, Part 1
44. The relation between locker plants and home freezers in the distribution of frozen
foods in Arizona, Part 2--Quantity buying for home-freezer storage
45. Farmers' produce markets in the United States, Part I--History and description

46. Farmers' produce markets in the United States, Part III--Shipping point fruit and vegetable markets (Mktg. Res. Report No. 17)
47. Marketing frozen foods--facilities and methods
48. Planning a wholesale frozen food distribution plant (Mktg. Res. Report No. 18)
49. Factors to be considered in locating, planning, and operating country elevators (Mktg. Res. Report No. 23)
50. Wholesale poultry and egg markets in 30 cities
51. The comparative efficiency of various arrangements of railroad tracks at stores in wholesale produce markets (Agric. Inf. Bull. No. 55)
52. Candling, sizing, packing and materials-handling equipment and methods used in egg assembly plants (Mktg. Res. Report No. 47)
53. How fresh fruit and vegetable distributors can get more out of their materials-handling equipment
54. Use of recording and transcribing equipment in loading delivery trucks of produce wholesalers (Agric. Inf. Bull. No. 43)
55. An analysis of some methods of loading out delivery trucks of produce wholesalers (Mktg. Res. Report No. 15)
56. The comparative efficiency of current methods and types of equipment used for receiving field boxes of apples at storage houses in the Pacific Northwest area
57. A portable mechanical lift for high-piling and breaking out high-piled boxes of apples
58. Apple handling methods and equipment in Pacific Northwest packing and storage houses (Mktg. Res. Report No. 49)
59. An improved method of stacking standard density bales of cotton in 'cordwood' arrangement
60. A comparison of two-wheel hand trucks and clamp-type industrial trucks for transporting uncompressed bales of cotton from blocked area to dinky press
61. An evaluation of the use of the portable platform dial scale for weighing operations in cotton warehouses
62. Some improved methods for receiving bales of cotton in compresses and warehouses (Agric. Inf. Bull. No. 80)
63. Cotton handling guide for warehouse managers and foremen (Mktg. Res. Report No. 50)

64. Visual inspection of products for surface characteristics in grading operations
(Mktg. Res. Report No. 45)
65. Some improved methods of handling groceries in self-service retail food stores
(Mktg. Res. Report No. 7)
66. The check-out operation in self-service retail food stores (Agric. Inf. Bull. No. 31)
67. Methods of handling and delivering orders used by some leading wholesale grocers
(Mktg. Res. Report No. 13)
68. How some wholesale grocers build better retailers (Mktg. Res. Report No. 12)
69. Marketing Florida prepackaged sweet corn
70. Prepackaging apples at point of production (Agric. Inf. Bull. No. 29)
71. Prepackaging spinach and kale
72. Retailing prepackaged meats
73. The cost of and reasons for rewrapping prepackaged meats, poultry, and cheese
(Agric. Inf. Bull. No. 77)
74. Consumer buying practices and preferences for purchasing oranges by weight or count,
in selected cities
75. Package and bulk selling of Florida oranges
76. Merchandising reconstituted frozen concentrated orange juice through the use of
mechanical dispensers
77. Improving the performance of retail food store cashiers through better training
methods (Mktg. Res. Report No. 48)
78. Packaging and displaying meats in self-service meat markets (Mktg. Res. Report No. 44)
79. Views of independent grocers on wholesaler-retailer relations (Mktg. Res. Report
No. 42)
80. Receiving, blocking and cutting meats in retail food stores (Mktg. Res. Report No. 41)
81. Better utilization of selling space in food stores
Part I--Relation of size of shelf display to sales of canned fruits and vegetables
(Mktg. Res. Report No. 30)
82. Test of refrigerator car equipped with split-absorption system of refrigeration
83. Test of a refrigerator car equipped with dry ice system of refrigeration

84. Transportation of frozen citrus concentrate by railroad and motortruck from Florida to northern markets (Agric. Inf. Bull. No. 62)
85. Transportation test of dry ice refrigerated truck trailer--Florida to Chicago--May 1951
86. Report of tests on transportation of frozen poultry with mechanically refrigerated trucks (an interim report)
87. The transportation and handling of grain by motortruck in the Southwest
88. A comparative study of packing, transportation, and refrigeration costs of bushel baskets and wire-bound boxes for transportation of peaches
89. Reduction of loss and damage in rail transportation of shell eggs by improved loading and bracing
90. Loss and damage in rail transportation of watermelons
91. Reduction of cantaloup loss and damage in rail transportation through use of the upright loading method (an interim report)
92. Comparisons of transit damages, loading time, and materials costs under various methods of loading cantaloups, 1951 (an interim report)
93. Loss and damage in rail transportation of dressed beef
94. A test comparing dry ice and mechanical refrigeration in the transportation of frozen citrus concentrate by motortruck
95. Some refrigeration tests of a motor truck-trailer equipped with one type of dry ice system of refrigeration
96. Test of a mechanical refrigerating unit designed to maintain low temperatures in motortruck transportation
97. A study of conditions affecting the transportation of grain by railroad
98. Tests of one system of dry ice refrigeration in the transportation of meat by motor truck-trailer
99. Reduction of loss, damage, and transportation costs in package-iced shipments of lettuce and carrots
100. Container breakage in top-iced shipments of vegetables
101. Loss and damage in the transportation of cantaloups, 1950-52
102. Test of a refrigerated truck trailer equipped with dry ice system of refrigeration using a secondary refrigerant

- *103. Program analysis--improving the effectiveness of wholesale market news services
- *104. The market news reporting job
- *105. Improving the reading ease of market news reports
- 106. The market news services of the United States Department of Agriculture
- *107. Uniform terminology for all market news services
- 108. Prices received by Iowa creameries for butter (weekly report, issued during period September 1949 to September 1950)
- 109. Terms used in livestock market news
- *110. Program for development of the market news service
- *111. Summary of a proposed program for development of the market news services
- *112. The relative prices paid creameries for 91 score and 90 score butter
- 113. Use of USDA livestock market news by northeastern slaughterers
- 114. Extent to which receivers of mimeographed livestock market reports also use livestock reports in newspapers and over radio
- 115. Types of dairy and poultry market news information reported by markets and areas-
 - Part I - Butter
 - Part II - Cheese
 - Part III - Shell eggs
 - Part IV - Frozen and dried eggs
 - Part V - Live poultry and rabbits
 - Part VI - Dressed poultry
 - Part VII - Dairy products other than butter and cheese
- 116. Reporting butter prices received by creameries (September 12, 1949 to January 22, 1950)
- 117. Market news reporting of butter prices received by creameries
- 118. What does the Iowa farmer want from radio market news?
- 119. What does the Iowa farmer want from newspaper market news?
- 120. Daily newspapers carrying USDA and Federal-State market reports
- 121. Use made of market news by daily newspapers
- *122. A national sample for retail market news
- 123. Retail market report for Baltimore (weekly report, issued during period July 1949 to December 1950)

124. Baltimore frozen food survey (monthly report, issued during period September 1949 to August 1950)
125. Retail and wholesale prices and price changes for fresh fruits and vegetables, Baltimore, Md. (weekly report, issued during period March 1950 to December 1950)
126. Retail market news as an aid in marketing (Mktg. Res. Report No. 19)
127. The market information needed on frozen food
- *128. List of terms used to designate U. S. grades
- *129. Relationships between USDA standards and Federal specifications for dairy products
130. Grade terminology used in USDA standards
131. Index of USDA standards for agricultural commodities
132. Variations in State standards and grades for eggs
133. Estimating volume of movement of individual food items through retail stores
134. A progress report on marketing service programs for the fiscal year 1952
- *135. Marketing service workshops-1952
136. Potential market outlets for mohair
137. Texas Livestock Auction Markets--Methods and Facilities

* Copies not available for distribution or supply exhausted.

